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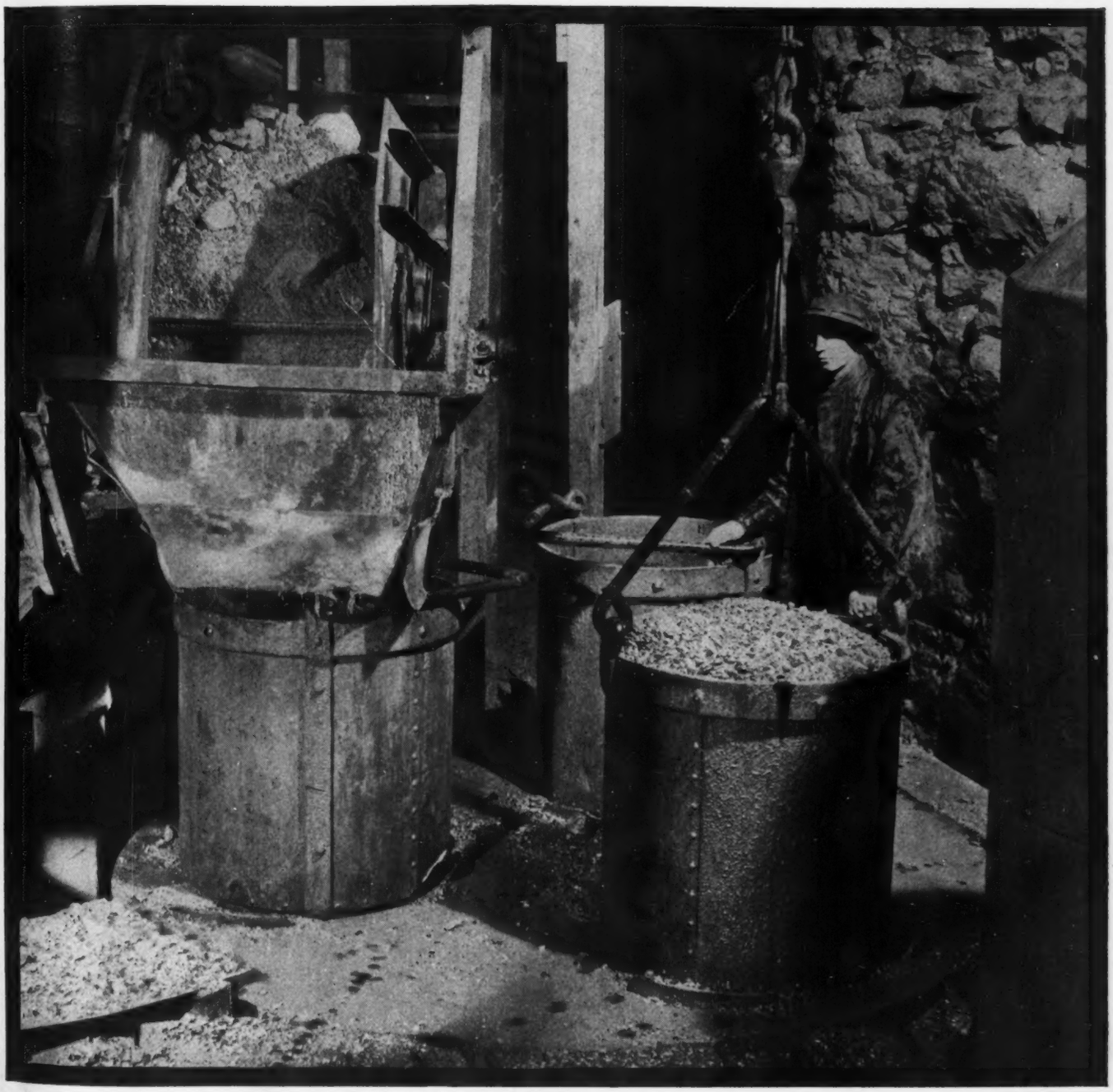

Hoisting zinc ore in an Eagle-Picher Tri-State mine. Cans on rotating deck are loaded by pan conveyor

Radioactive Tracers in Ore-Dressing Research — Page 53

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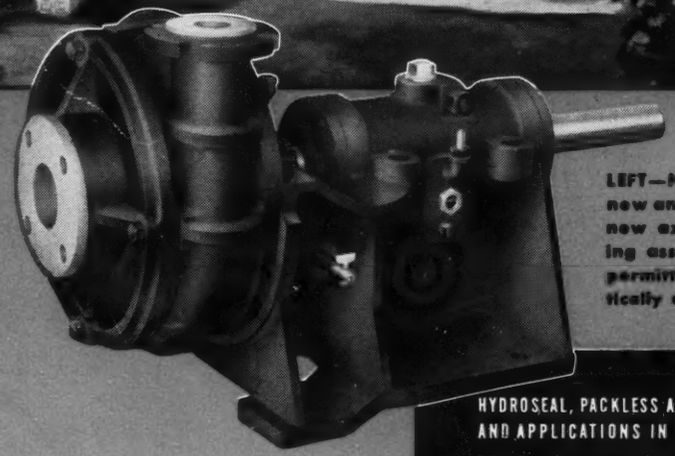

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Volume 149 **Number 3**

A McGRAW-HILL PUBLICATION

McGRAW-HILL PUBLISHING COMPANY, INC.

James H. McGraw (1860-1948)
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Publication office: 210 S. Desplaines St., Chicago 6, Ill. Editorial and Executive Offices: 330 West 42nd St., New York 18, N. Y. Cable Address: McGraw-Hill, New York. Branch Offices: San Francisco 4, 68 Post St.; Chicago 11, 520 N. Michigan Ave.; Los Angeles 14, Pacific Finance Bldg.; Washington, D. C., National Press Bldg.; Pittsburgh 22, 738-9 Oliver Bldg.; Detroit 26, 2980 Penobscot Bldg.; Cleveland 15, 1510 Hanna Bldg.; Boston 16, 1427 Statler Bldg.; Philadelphia 3, 17th & Sansom Sts.; Atlanta 3, 1011 Rhodes-Haverty Bldg.; St. Louis 8, Continental Bldg. District Managers: New York, T. E. Alcorn, F. W. Roets; Philadelphia, W. A. Porter; Cleveland, W. M. Spears; Pittsburgh, H. C. Chellson; Chicago, C. J. Coash and G. A. Mack; San Francisco, J. W. Otterson; Atlanta, R. C. Maultsby; Los Angeles, R. N. Phelan. London address: McGraw-Hill Publishing Co., Ltd., Aldwych House, Aldwych, London, W.C. 2, England. Cable address: Blacklash, Estrand, London. Other McGraw-Hill foreign news offices in Paris, Berlin, Moscow, Prague, Shanghai, Bombay and Mexico City.

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Subscription Information

ENGINEERING AND MINING JOURNAL, March, 1948, Vol. 149, No. 3. Published monthly at Chicago, Ill. Return postage guaranteed. Subscription rates: United States and possesions $3 a year, $4 for 2 years, $5 for 3 years. Canada $4 a year, $6 for 2 years, $8 for 3 years. Pan American countries $5 a year, $8 for 2 years, $10 for 3 years. Elsewhere $8 a year, $12 for 2 years, $16 for 3 years. Please indicate position and company connection in all subscription orders. Price of this issue, 50 cents. Entered as second class matter October 27, 1947, at the Post Office in Chicago, Illinois, under the act of March 3, 1879.

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The 600-ton capacity mill of Coeur d' Alene Mines Corp. in northern Idaho near Osborne. Secondary crushing is handled by a Telsmith Crusher.

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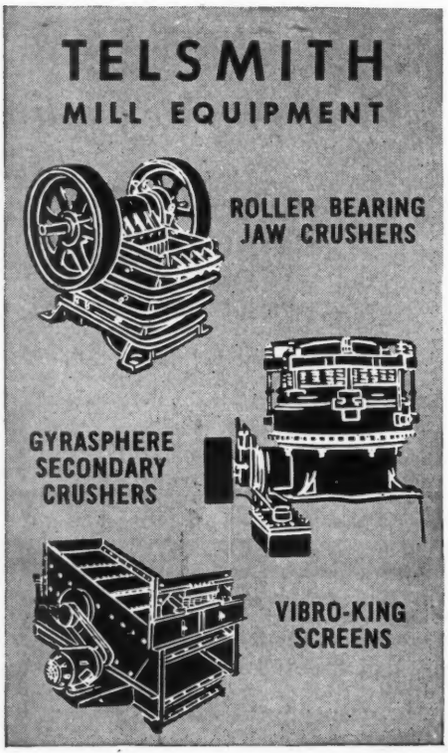

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ENGINEERING AND MINING JOURNAL

MARCH, 1948

We Can Further Peace

THE ONLY REAL HOPE for peace in the next ten years is a United States strong enough to be an uninviting adversary. Disappointing as a primitive balance-of-power world may be to those who long for peace through intelligent cooperation, the distrust between the United States and Soviet Russia is so deep that nothing but a balance of power seems likely to keep the peace in the foreseeable future. Each side fears the other, each is strongly opposed to the other's way of life, and neither can believe that, given an important advantage, the other would be willing to cease further encroachment.

American tradition opposes minority or terroristic rule, and the United States would consider itself insecure if it should look across either ocean at Russian domination. The Soviet, on the other hand, is convinced that capitalism will never permit communism to flourish unimpeded, and Russia will never feel safe with the United States playing a strong hand in Europe or Asia. The only basis for peace is true neutrality on both sides toward Western Europe and the Far East, or an uneasy balance of power in these areas. There is too little mutual trust for true neutrality and too many elements in both Europe and Asia are willing to utilize outside force to advance local supremacy. Thus, a successful balance of power is the only feasible solution.

Considering our side of this problem, it seems quite evident that the Soviet will not take final steps toward war with a power having an important preponderance of modern weapons or double the Russian heavy industry capacity. Unless the United States become woefully negligent, it will enjoy these advantages until some time beyond 1960. Meanwhile the only safe policy is to maintain American strength and make it clear that we will not retreat beyond a balance of power in Western Europe and the Far East. We must also demonstrate our willingness to avoid encroachment in the opposite direction, otherwise Russia will be goaded to desperate measures.

Two vital elements in adequate national strength are a healthy domestic mining industry and large stockpiles of essential raw materials. The mining industry can and should lend itself to building up these pillars of security by settling its internal controversies constructively, by modernizing its functions, by extending its ore reserves, and by cooperating in the building of stockpiles, even if some sectional aspirations are unfulfilled or some customers go unsatisfied. Peace in our time is an objective of sufficient consequence to every citizen to be worth some genuine attention and sacrifices.

Evolution of the Art of Hole Making

NEW DEVELOPMENTS in rock drilling and boring seem to be crowding each other, in comparison with the less numerous changes in other mining operations. This is hardly the result of chance. Rather it has come about because improvements in equipment and procedure have been fostered by the need of lowering the costs of breaking ground and of exploration work.

The last 15 years have seen a succession of these changes. Conventional steel has given way to detachable bits to a large extent and competition has developed between the re-use type and the throw-away type of the latter. Sharpened steel of alloy composition and smaller than usual diameter has been adopted by some of the mines that continued to use the conventional steel, and, independently of this, an alloy-steel stud connection that will facilitate use of smaller detachable bits has been developed. Both of the latter developments have been pointed towards the use

of a smaller-diameter drill hole and faster and cheaper drilling. Still another trend has been the adoption of diamond drills for blast holes underground for certain types of orebodies and other conditions. And while these varying practices were all enjoying simultaneous use, the drilling situation has been jolted rather suddenly and spectacularly by the introduction of tungsten carbide as a rock-drilling medium. The promising performance of this material in its new application augurs well for the future of rock drilling but tends to confuse the present situation.

This is not the end of the present story of the evolution of the art of making blast holes. New chapters are being added. A new rock-drilling medium of interesting capabilities, used successfully, it is reported, in England in oil-well work, is brought to the attention of *E. & M. J.* readers on page 73 of this issue. Another chapter of the story deals with the progress of jet-piercing, as fusion-piercing has been renamed. See pages 74-76. What goes on in the hole pierced is said to be spalling rather than fusing, there being little of the latter. Interestingly, the first commercial jet-piercing rig for making surface blast holes is being built by a prominent churn-drill manufacturer in collaboration with the company that has developed the piercing process.

Still another chapter tells how the old steam-driven piston drill has been re-designed for efficient work with compressed air as power, and has been applied in a mobile, self-contained rig to drilling surface blast holes up to six inches in diameter and 70 ft. deep with well-type bits. The results obtained are also described elsewhere in this issue (pp. 64-65). All things considered, it is evident that the art of making blast holes is being rapidly improved.

Hopes For General Devaluation Are Premature

MUCH AS WE WOULD LIKE to report otherwise, we feel duty bound to express the opinion that jubilation on the part of gold producers over the French Government's action in devaluing the franc is premature.

This is not saying that the event is bad news for gold producers. On the contrary, we regard it as an early phase of a process that will gradually become universal, or nearly so, and will eventually result in a higher price for gold. Probably a better way of saying it is that gold vis-a-vis other costs will be brought back into balance, by deflation or devaluation, or a combination of both. However, the fulfillment is not close at hand, and may take many years.

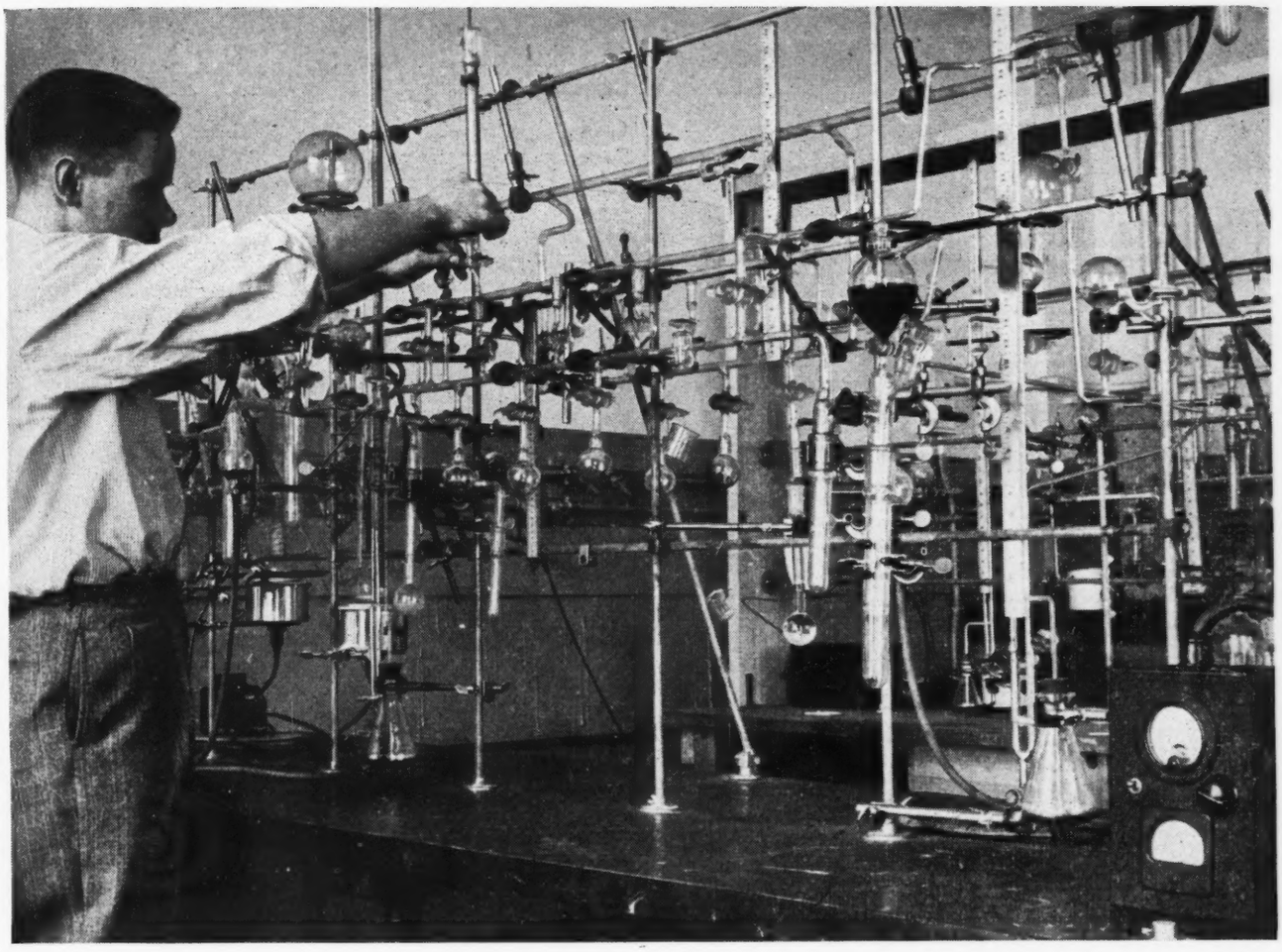
The United States Treasury will contest devaluation and pronounced deflation every foot of the way. The latter will be opposed because our huge national debt would become unmanageable in a well deflated economy. Devaluation will be opposed for the very laudable reason that it is simply a bankruptcy process, with creditors of all kinds holding the sack, and the Treasury is trying to protect the integrity of Government borrowings. In other words, the Treasury is doing what it can to see that John Jones and Mary Smith get back the purchasing power they lent it when they bought U. S. savings bonds, plus interest. With this objective no good citizen can quarrel. There is a price to devaluation, a price of serious consequence to all except the have-nots, and to a Government that must continue to borrow from a more or less free people.

Nevertheless, in the course of national affairs there usually comes a time when governments which have spent beyond their means find that lack of confidence in currency inspires hoarding and inhibits trade. This is the predicament in which France found itself, with little hope of making its debts good. In such a situation, the integrity of government borrowings is already destroyed and national bankruptcy is the only way to restore trade and confidence in the currency.

Under these circumstances, devaluation is a necessary housecleaning. The real crime against the defrauded creditors is not the acknowledgment of bankruptcy but the chain of improvident acts or wartime demands which created insolvency.

In our opinion the pound will follow the franc before long, partly because British vitally needed exports cannot stand the competition of those who have devalued and partly because Britain's capacity to honor its debts in prewar values is questionable.

However, devaluation by Italy, Russia, France, and Great Britain still means no change for gold as long as the United States is the only important recipient of the metal. The United States is in a position to withstand devaluation pressure as long as it can endure substantial handicaps to its export business and can retain the confidence of creditors in the integrity of its borrowings. These conditions seem likely to prevail for some time to come.



GEIGER COUNTER TUBE is evacuated by F. W. Bloecher in analysis of radioactive reagents in Richards mineral engineering lab., M.I.T.

Radioactive Tracers

How They Can Be Used in Flotation Research

ANSWERS TO MANY QUESTIONS that still block full knowledge of flotation fundamentals may soon be furnished by the technique pictured on these pages. Its purpose is simply to trace the movements of flotation reagents, or their ions, among the several phases or products of a flotation operation.

The tracing is done by following, as one would locate a belled cow, the electron emissions from radioactive atoms that have been built into the reagent in question. These emissions can be made to register as either a flash or a click in a Geiger counter apparatus.[1]

Thus, if one uses radioactive copper sulphate in a zinc float, the Geiger counter can quickly tell you not only that copper left the cell on the zinc mineral, but also that a certain definite quantity left in that way. This is probably the simplest example of what the method can do.

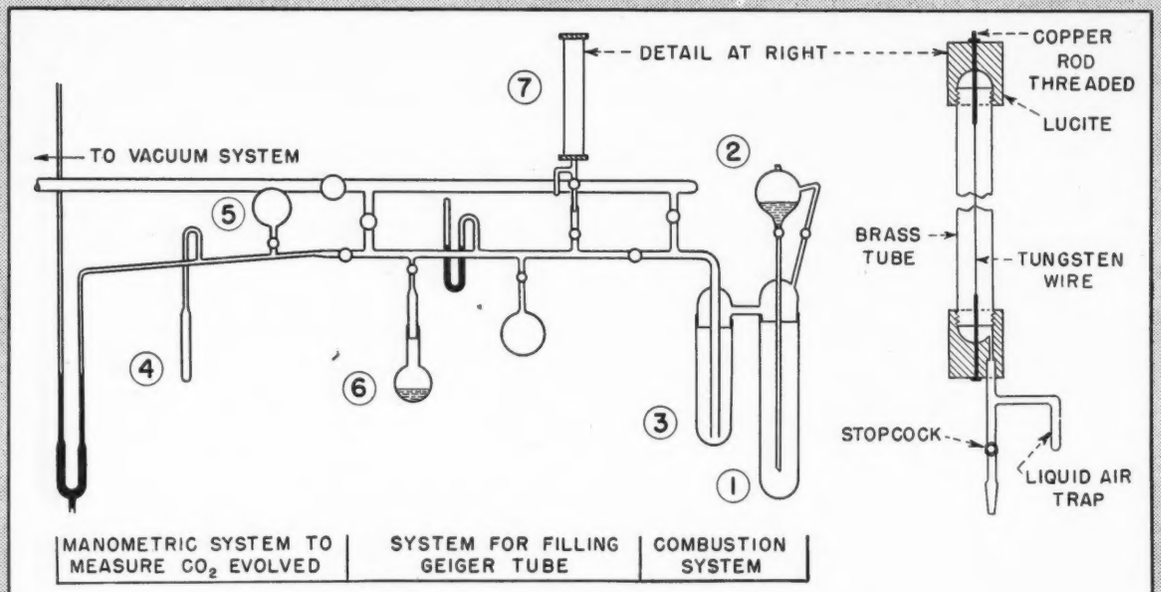
A. M. GAUDIN, Richards Professor of Mineral Engineering, M. I. T.

The three men who appear in these pictures are working at Massachusetts Institute of Technology, under the direction of Professor A. M. Gaudin, to apply this technique to investigating the behavior of flotation reagents at mineral surfaces. The work is done under a grant from the Chemical Division of Armour & Co.

Messrs. de Bruyn, Chang, and Bloecher use carbon 14 as the radioactive atom because: 1, carbon can be built into so many flotation reagents; 2, carbon 14 is easy to get from Oak Ridge, Tenn.; 3, it remains radioactive for long periods;

[1]See A. W. Knoerr, *Geiger-Mueller Counters Applied to Mining. E. & M. J.*, July, 1947.

RADIOACTIVE TRACERS *(continued)*

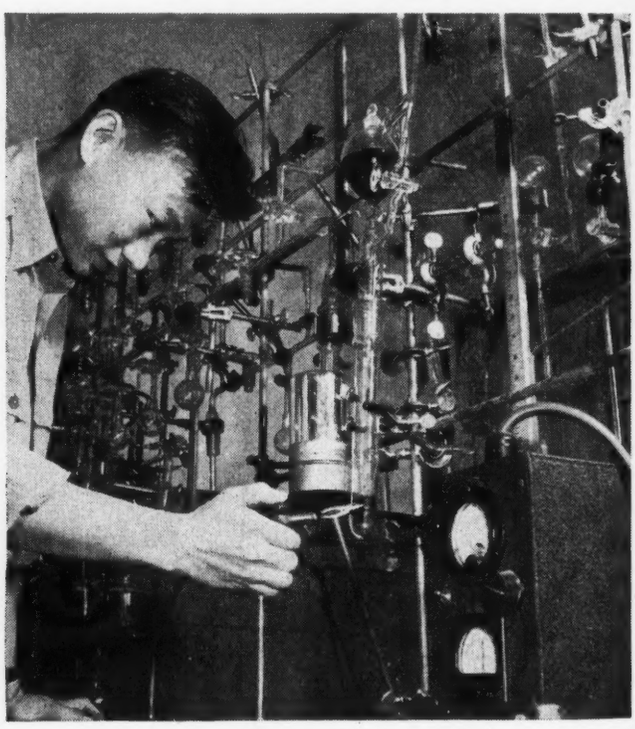


ELEMENTS of system are: Combustion tube for sample (1). Bulb holding mixed sulphuric, phosphoric, chromic acids (2). Liquid oxygen traps (3) and (4), and calibrated flask (5) to measure volume and pressure of radioactive CO_2 evolved. Bulb (6) holding CS_2 to go into Geiger tube (7) along with CO_2, where radioactivity of sample is finally measured by counting.

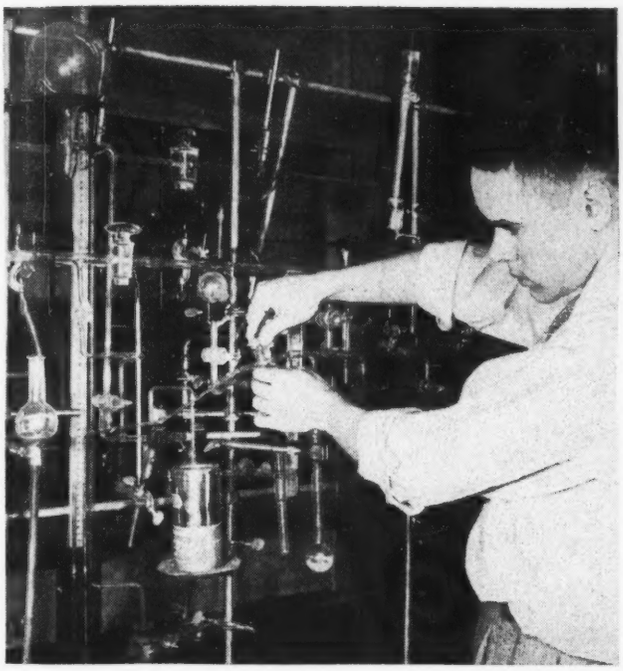
INSIDE GEIGER TUBE, each radiation from carbon 14, ionizes gas, triggers discharge between tungsten wire and brass tube.

SIMPLIFIED SKETCH OF SET-UP FOR ANALYZING RADIOACTIVE REAGENTS. Purpose is to find out where, and in what quantity, certain reagents, made radioactive, come to rest in flotation pulps. The method, shown in photographs, offers interesting research possibilities.

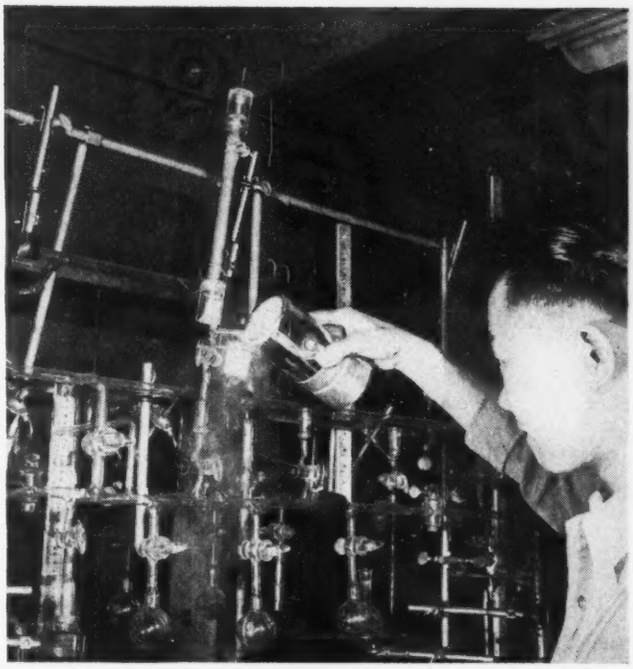
SAMPLE of reagent carrying carbon 14 is weighed (1-5 mg.) on gold balance by P. L. de Bruyn. Sample goes on filter disk, disk goes into combustion tube (foreground) ready for combustion fluid.



2 COMBUSTION of sample (Point 1 in sketch) is shown by C. S. Chang. Fluid covers sample, heating drives carbon as CO_2 into vacuum line to Thermos-covered liquid oxygen trap behind burner.



3 FRACTIONAL DISTILLATION moves CO_2 on into manometric system (Point 5 in sketch). Pressure of known volume of CO_2 is measured by Bloecher to check completeness of the combustion.



4 LIQUID OXYGEN brings CO_2 over into Geiger tube (Point 7 in sketch), which already holds 1-3 cm. (Hg pressure) of the CS_2 needed for proper tube operation. Chang adds oxygen to trap.

5 GEIGER TUBE, carrying radioactive CO_2 from sample, goes on rack, is connected to high voltage and to scaler that measures sample's activity by counting discharges of electrons inside the tube.

6 AUTOMATIC SCALER tells quantity of carbon 14 in original sample in terms of "counts per minute." Flashing neon lights (center) and mechanical counter (top) show the disintegration rate.

4, its radiation is measurable but not strong enough to endanger laboratory personnel.

Their work is now in the calibration stage. They take a sample carrying a known quantity of a flotation reagent made with carbon 14, and put it through the routine shown on these pages. The result is a record of a definite rate of radioactive emissions for each sample.

After they have repeated this procedure over a wide range of samples, it will be easy to take an unknown and, from the rate of discharges counted, tell accurately how much of the radioactive reagent it contained. At present, such data are being compiled for lauric acid, certain amines, sodium cyanide, and ethyl xanthate. For further details on the procedure, see a paper prepared by Professor Gaudin and his associates for the A.I.M.E. in February, 1948.

These are some of the things the group hopes to do with this tracer technique:

1. Measure mineral surfaces more accurately.
2. Check on stability of collector coatings on mineral surfaces.
3. Measure concentration of other ions, as a pH meter measures hydroxyl ions.
4. Study the whole gamut of collector ions with regard to their preferential attachment to mineral surfaces.

KNOB HILL'S FLOTATION-CYANIDE PLANT in Republic district, north-central Washington.

Knob Hill Mine Prospers

The ores mined and developed in Knob Hill mine since the additional discoveries in 1939 have equalled in value the total prior yield of the Republic district.

JOHN B. HUTTL
Associate Editor

IN RECENT YEARS THE DISCOVERY of new ores in the Knob Hill gold mine, in north-central Washington, have made it interesting as a producer and attracted new attention to the Republic district, 18 sq. mi. in area, in the north end of which it is situated. The property is between two and three miles from the town of Republic. Several gold-silver deposits occur in the district.

Discovery of the mines dates back to 1896. For 40 years production was rather small, the orebodies worked being narrow and regarded as of shallow depth. The metallurgy, moreover, as developed, was inadequate for treating the complex ores mined. Between 1897 and 1914 production is said to have been about 300,000 oz. of gold and 1,000,000 oz. of silver. For the next 22 years activities were confined chiefly to leasing. When the price of gold rose to $35 an ounce, interest reawakened in the district. In 1936, Knob Hill Mines, Inc., of San Francisco, took over the Knob Hill holdings.

General Geology

The general geology of the district has been described by Lawrence B. Wright in a recent monograph.[1] He says:

"The ore deposits are arranged along the flanks of an anticline. The axis of the anticline trends northward through the vicinity of Mud Lake. The nose of the fold plunges flatly northward and is last seen north of the Mountain Lion mine.

"Most of the ore occurs along the east flank, emplaced in a series of openings having dips steeper than the enclosing rocks. A feldspar-rich series of flows, termed the Knob Hill andesite, is the principal host. These flows are exposed at the New Republic mine, at the south end, and northward the ores are exposed along Eureka Gulch and Knob Hill mine area to the nose of the fold. The west flank ore, except for the Mountain Lion mine, has been less important. The andesite host on this limb of the fold is recumbent at shallow depth on the granodiorite of Granite Mountain along the main thrust zone.

"The Knob Hill andesite is overlain by Miocene shales grading upward into sandy beds with intercalated tuffaceous flows; all are participants in the folding. Beneath the Knob Hill andesite there are tuffaceous and coarsely fragmental flows resting on the folded Paleozoic basement.

"Intrusive into the whole are several dikes of dacite and diorite. Two of these dikes are seen cutting folded sediments one half mile west of Republic."

Present Ore Sources

Production from the Knob Hill property up to 1914 came principally from the Knob Hill and Alpine veins. These were among the first to be discovered in the district. They were of the fissure type and 4 to 5 ft. thick, and ended at relatively shallow depth. When Knob Hill Mines, Inc., began work in 1936, they centered their attention on the mining, by open-cut methods, of the Mud Lake low-grade ore in

[1] "Geologic Relations and New Orebodies of the Republic District, Washington," L. B. Wright. *Mining Technology*, July, 1947.

SURFACE PLANT AND HEADFRAME at Knob Hill's 720-ft. shaft.

on Newer Ore Discoveries

the upper Knob Hill andesite. During this work, new "cross-vein" breccia ores were discovered in 1939, in what are known as the Stewart and South Cross veins.

These ores are unlike other ores in the district, both in mineral composition and grade. The outcrop of the Stewart orebody, situated west of and in the footwall of the Mud Lake disseminated ore, was discovered while removing overburden by bulldozer along the footwall during pit operations. In contrast, discovery of the South Cross vein came about through a comprehensive geological field study which showed ore in place in the breccia dikes along the South Cross fault and was followed by churn drilling. Early miners, driving through a low-grade section of the brecciated area, missed this important orebody by 30 ft. They also missed the Stewart orebody by 6 ft., farther north in the same working.

Little Free Gold Seen in South Cross Vein

The South Cross vein, which is currently under production, has a stoping width of about 22 ft., widening in places to 50 ft. Dip is 45 deg. Ore values are considerably higher than those of the Mud Lake ores, formerly mined by open-cut methods. Spur veins branching off the footwall end of the main orebody are a source of rich ore. Angle of departure and length vary, and, save for spurs less than 20 ft. long which are mined within the main stoping pattern, all are worked as separate units by methods suited to their particular dimensions. Ore minerals in the South Cross vein system are unusually fine-grained, and free gold is seldom seen even in the richest concentrations. They occur most characteristically in concentric banding of cherty quartz, calcite, and adularia. Individual minerals observed include quartz, chalcedony, adularia, sericite, calcite, graphite, barite, gold, pyrite, realgar, marcasite, tetrahedrite, polybasite, pyrargyrite, and stibnite.

Pit operations, which furnished Mud Lake disseminated ore to the 500-ton cyanide mill erected in 1937, ceased in 1942. Active development of the South Cross orebody started in 1941 by sinking a three-compartment, 50-deg., inclined shaft. This now has reached a total depth of 720 ft. Five working levels have been established, mining being done on four. A shaft station and ore pocket are being cut on the fifth, or lowest, level. Level No. 1 is 180 ft. below the surface. Distances on the incline between levels 1, 2, 3, 4, and 5 are 125 ft., 150 ft., 125 ft., and 150 ft. respectively. The 5x15-ft. cross-section of the main shaft is divided into three compartments, and the 2-ton skips used are handled by a 150-hp. double-drum, electric hoist. Development drifts are 5x7 ft. in cross-section.

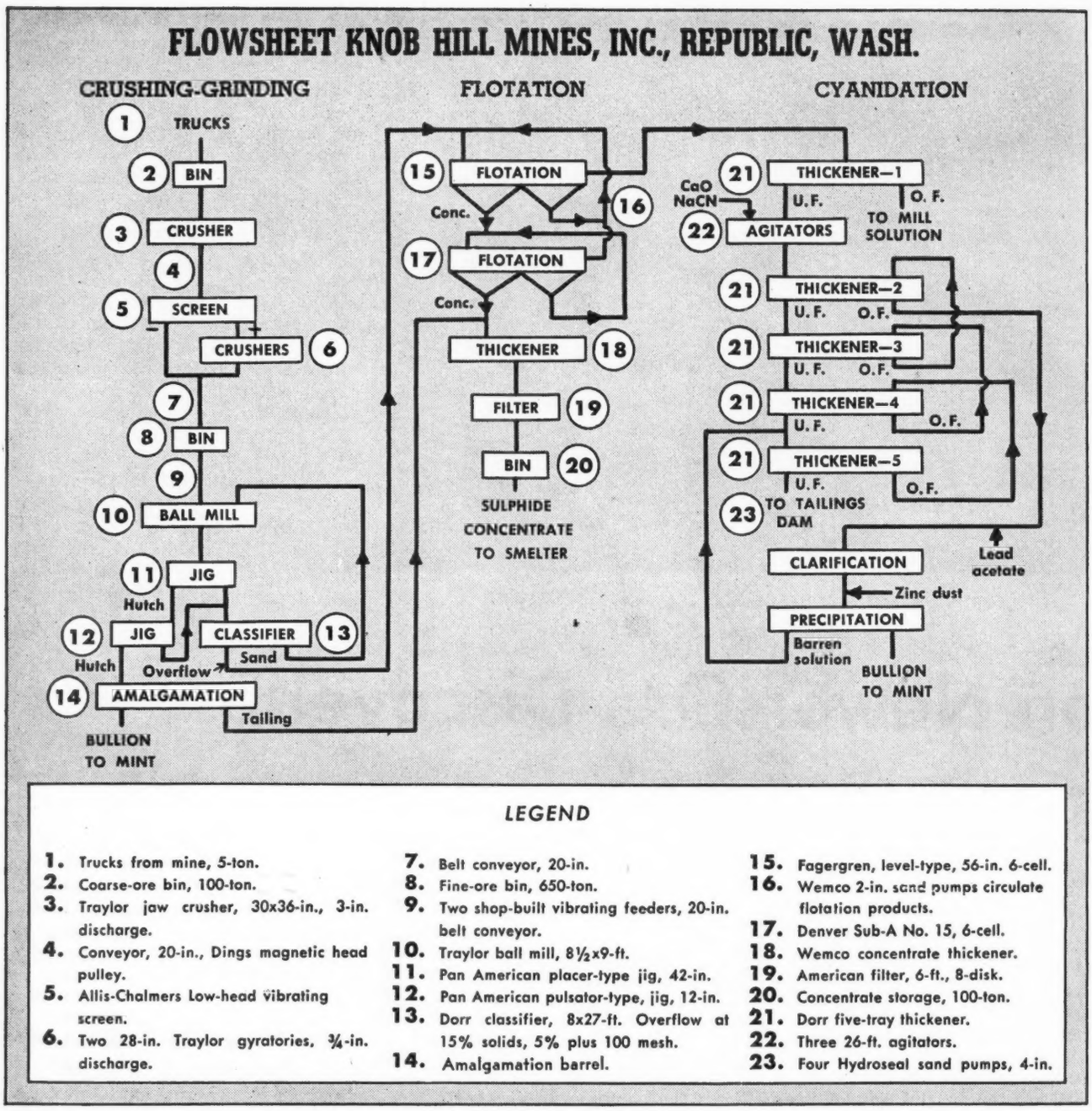
Long-Hole Drilling Used for Prospecting Walls

Vein walls are prospected by long-hole drilling with drifters, using sectional steel. These machines are used for holes up to 100 ft. in length. For longer holes, diamond drills are employed. Surface exploration drilling is done with churn drills. One of these is now in operation at the neighboring Mountain Lion property controlled by the company. I-R drifters and side-hole Jackbits are employed in drift work. Ore broken in the lateral openings is loaded into 1-ton end-dump cars by Eimco rocker shovels and subsequently hand-trammed to the shaft pockets. Track gage is 18 in., and the rails are laid on a half-percent grade. Ore is hoisted in 2-ton skips and transported from the loading bin to the 500-ton mill which is situated half a mile away by 5-ton International trucks.

Opening Up the Vein

A vein section is developed for stoping, in general, as follows: A drift or tunnel is driven 250 ft. from the shaft into ore, and a raise is put up on the vein to level above for ventilation and emergency exit. A sublevel is then started 25 ft. above the drift and driven on the footwall for 50 ft. and a chute built. After this, both openings are driven ahead simultaneously, with chutes at 50-ft. intervals. Ore that is broken in the lower drift is handled by an Eimco rocker shovel. That which is broken on the sublevel is scraped to the chutes by I-R scrapers.

The ore, when developed, is mined by square-set stoping. Heavy ground in the hanging wall area necessitates close timbering and back-filling. Panels are 25 to 35 ft. long, depending on the ground. They are taken up the entire width of the



LEGEND

1. Trucks from mine, 5-ton.
2. Coarse-ore bin, 100-ton.
3. Traylor jaw crusher, 30x36-in., 3-in. discharge.
4. Conveyor, 20-in., Dings magnetic head pulley.
5. Allis-Chalmers Low-head vibrating screen.
6. Two 28-in. Traylor gyratories, ¾-in. discharge.
7. Belt conveyor, 20-in.
8. Fine-ore bin, 650-ton.
9. Two shop-built vibrating feeders, 20-in. belt conveyor.
10. Traylor ball mill, 8½x9-ft.
11. Pan American placer-type jig, 42-in.
12. Pan American pulsator-type, jig, 12-in.
13. Dorr classifier, 8x27-ft. Overflow at 15% solids, 5% plus 100 mesh.
14. Amalgamation barrel.
15. Fagergren, level-type, 56-in. 6-cell.
16. Wemco 2-in. sand pumps circulate flotation products.
17. Denver Sub-A No. 15, 6-cell.
18. Wemco concentrate thickener.
19. American filter, 6-ft., 8-disk.
20. Concentrate storage, 100-ton.
21. Dorr five-tray thickener.
22. Three 26-ft. agitators.
23. Four Hydroseal sand pumps, 4-in.

FLOTATION OF SULPHIDES, following grinding to 5% plus-100-mesh, and cyanidation of tailings feature Knob Hill flowsheet used on South Cross ore. Approximately 4,000 tons of ore is treated monthly, the concentrates being shipped to Tacoma.

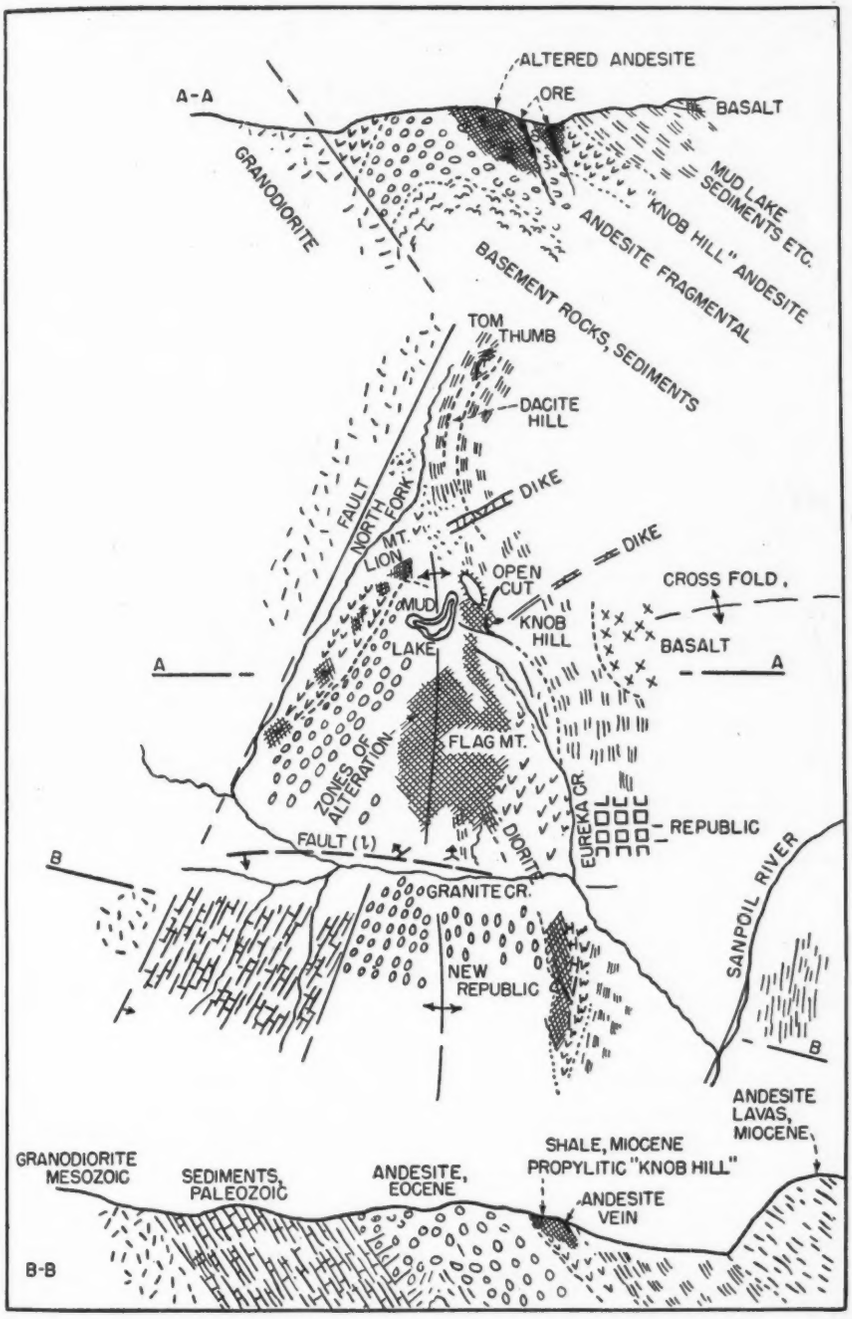
orebody, three to five floors being stoped at a time and before backfilling. The sets, made from round timber, measure 5x5x7 ft. In the spur veins mentioned half sets are used, and not all are backfilled.

Cheap Backfilling

Backfill material is obtained in a way that is based on the fact that the hanging-wall rock caves easily. At the top of the panels a crosscut is driven into the hanging wall in a manner so as to serve four panels. After it has reached the predetermined distance from the vein (75 to 100 ft., depending on the ground and the permissible scraping length), it is split in Y-fashion and each arm of the Y advanced about 120 ft. (which is the optimum slushing distance). A series of finger raises is driven from each branch. A small amount of stoping at the juncture of a set of raises will now bring about the caving of the ground. The caved material is scraped in one pass to fill the raise above the square-set stope panels. Scrapers are used also in the panels proper for spreading the backfill. Stopes are mined and backfilled according to an established ratio.

The mine water is very acidic, but fortunately not large in volume. It is handled by a special stainless-steel I-R 100-gpm centrifugal pump driven by a 30-hp. motor installed on the No. 4 level. Save for bends and fittings of stainless-steel construction, the 4-in. vertical discharge column is composed of standard pipe. It has been found that a crust which protects against corrosion forms inside the pipe after a period of operation.

Most underground work is done on contract. This includes development drifts, stoping, tramming, scraping, and backfilling. Mine tim-



STRUCTURAL GEOLOGY and ore control in Republic district, Washington, after Lawrence B. Wright, Mining Technology, July, 1947.

ber is prepared in a framing shop near the shaft. Around the latter are grouped also the mine office, change house, compressor house (containing two I-R, Imperial, type-10 air compressors) and a small repair shop. The old Knob Hill shaft near the mills is being unwatered and retimbered preparatory to exploration of this section of the property.

Milling Operations

The South Cross ore now handled in the 500-ton mill is hard and abrasive. Monthly production amounts to about 4,000 tons. The gold-silver ratio is 1:5. Milling follows modern gold recovery practice, with removal of sulphide minerals by flotation, and retreatment of tailings in a cyanide unit. The accompanying flowsheet on the opposite page gives the details of the procedure. Coarse ore from the 100-ton storage bin is reduced to the proper size for ball-mill feed, or to minus ¾-in. by crushing in two stages.

Grinding to 5% plus-100-mesh is done in a ball mill-classifier unit consisting of a 8½x9-ft. Traylor ball mill and an 8x27-ft. Dorr classifier. Between these two units is a 42-in. Pan American placer jig. The finished classifier product overflowing at 15% solids is treated in a bulk roughing and cleaning flotation step as has been shown in the flowsheet.

Finished concentrates, after being thickened and filtered, are stored in a 100-ton bin for shipment to the Tacoma smelter. Tailings go to cyanidation. The hutch product of the jig is treated in a 12-in. Pan American pulsator jig, the hutch product of which goes to an amalgamation barrel. Bullion is shipped to the United States Mint in San Francisco.

Consumption of Reagents

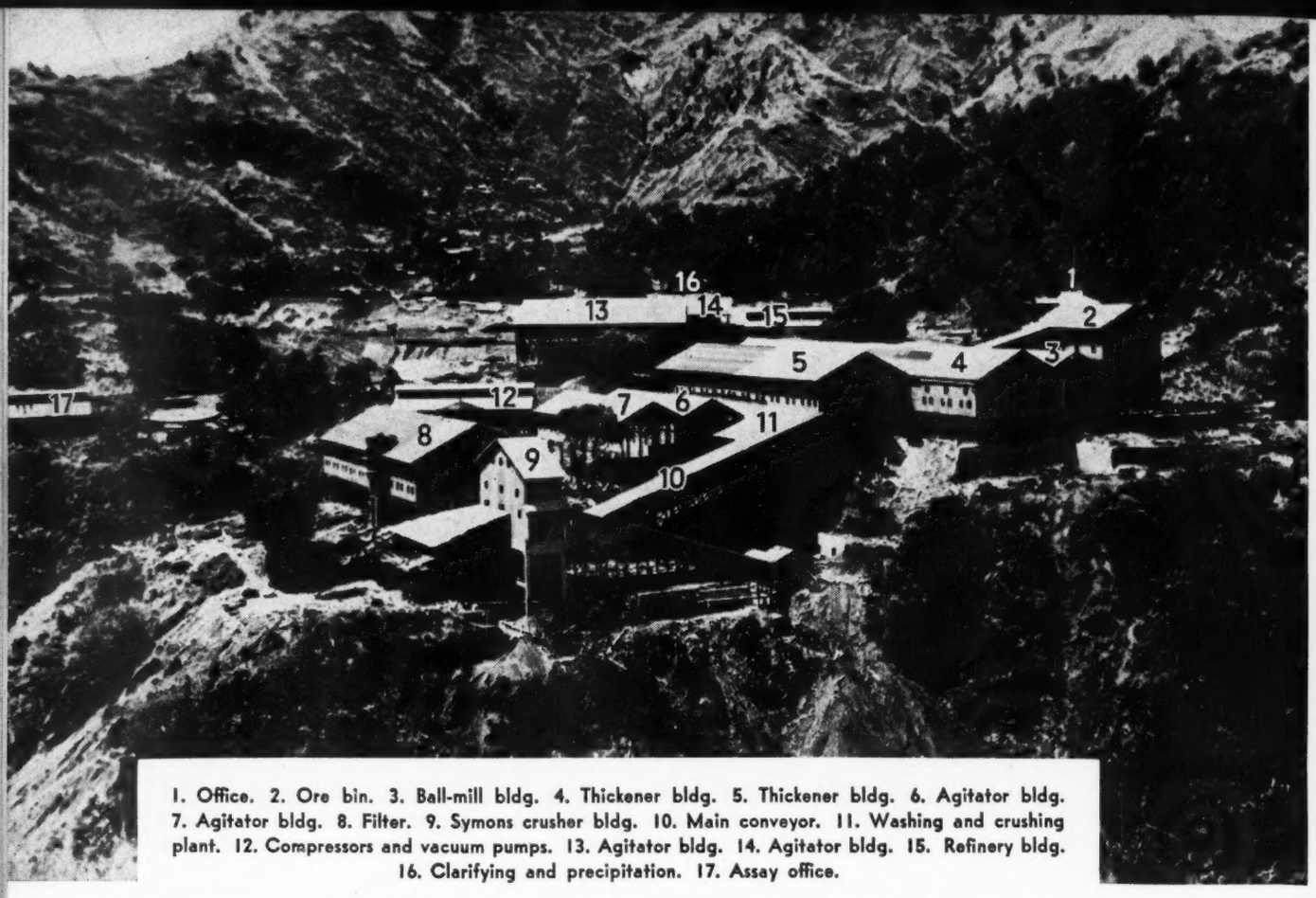
Reagent consumption per ton of ore treated is: Copper sulphate, Aerofloat No. 25, and A.C.C. No. 404, each added to the ball mill, 0.20 lb., 0.10 lb., and 0.04 lb. respectively; DuPont frother B-23, to cell 1, 0.025 lb.; Z-6, to cells 1 and 4, 0.025 lb.; and sulphuric acid, to cell 1, 0.25 lb. The last-named reagent is added to maintain a pH of about 6.5.

As to those in the cyanide plant, 1.5 lb. of sodium cyanide is added to agitator No. 1; and 8 lb. of lime to aerator No. 1. Zinc-dust consumption per ton of solution is 0.025 lb. Steel consumption is: crusher parts, 0.05 lb.; cast steel balls, 7 lb.; and ball mill liners, 0.60 lb. The latter are of the Britannia type.

Water for plant operation is obtained from two sources: a pumping plant on the 125-ft. level of a neighboring property and consisting of an I-R 2MRV-30 motor pump; and from the Sanpoil River. Here, an Allis-Chalmers 9-stage centrifugal pump driven by a 100-hp. motor provides supplementary water, during the dry season or whenever it may be needed, through a 5-in. pipe line that is four miles long and pumping against a 1,000 ft. head.

The total number of men employed by the company currently is 68. Of these 32 are employed underground. Electric power is obtained from the Washington Water Power Co.

Walter Lyman Brown is executive vice president of Knob Hill Mines, Inc.; Frank Wagner is superintendent. The operating officials include Tom Pittman, chief engineer; J. E. Davis, mine foreman; A. R. Patterson, mill superintendent; and Louis Lembeck, mill foreman.



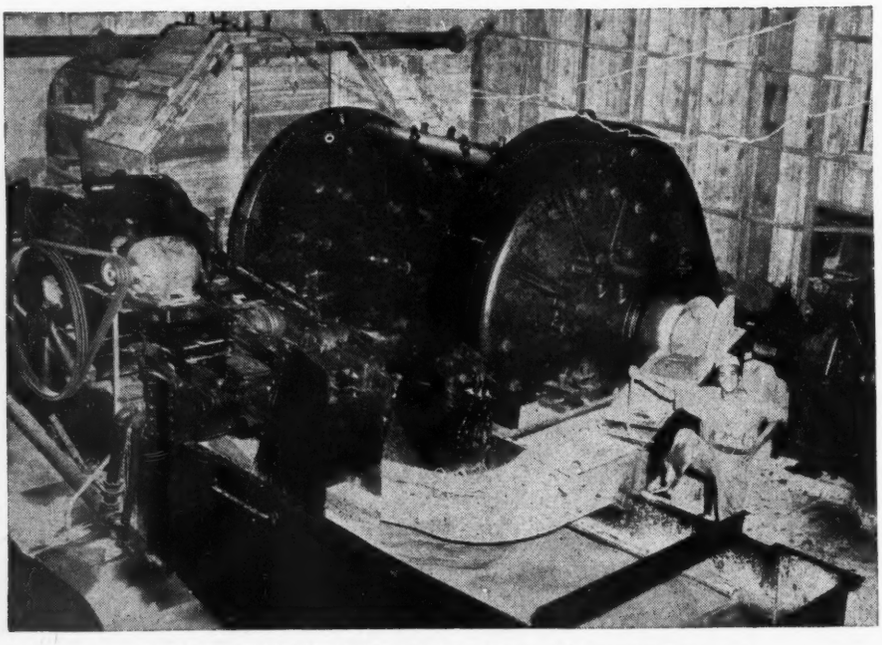
1. Office. 2. Ore bin. 3. Ball-mill bldg. 4. Thickener bldg. 5. Thickener bldg. 6. Agitator bldg. 7. Agitator bldg. 8. Filter. 9. Symons crusher bldg. 10. Main conveyor. 11. Washing and crushing plant. 12. Compressors and vacuum pumps. 13. Agitator bldg. 14. Agitator bldg. 15. Refinery bldg. 16. Clarifying and precipitation. 17. Assay office.

CENTRAL MILL at Baguio will serve Benguet, Balatoc and Cal Horr mines, the plants of which were destroyed in the war.

Rehabilitation of Mines in

Despite discouragements, the industry in the Islands, including producers of gold, chrome ore and manganese, is making definite but gradual recovery. War damage claims await adjustment.

W. F. BOERICKE*
Mining Consultant
Hayden, Stone & Co.
New York

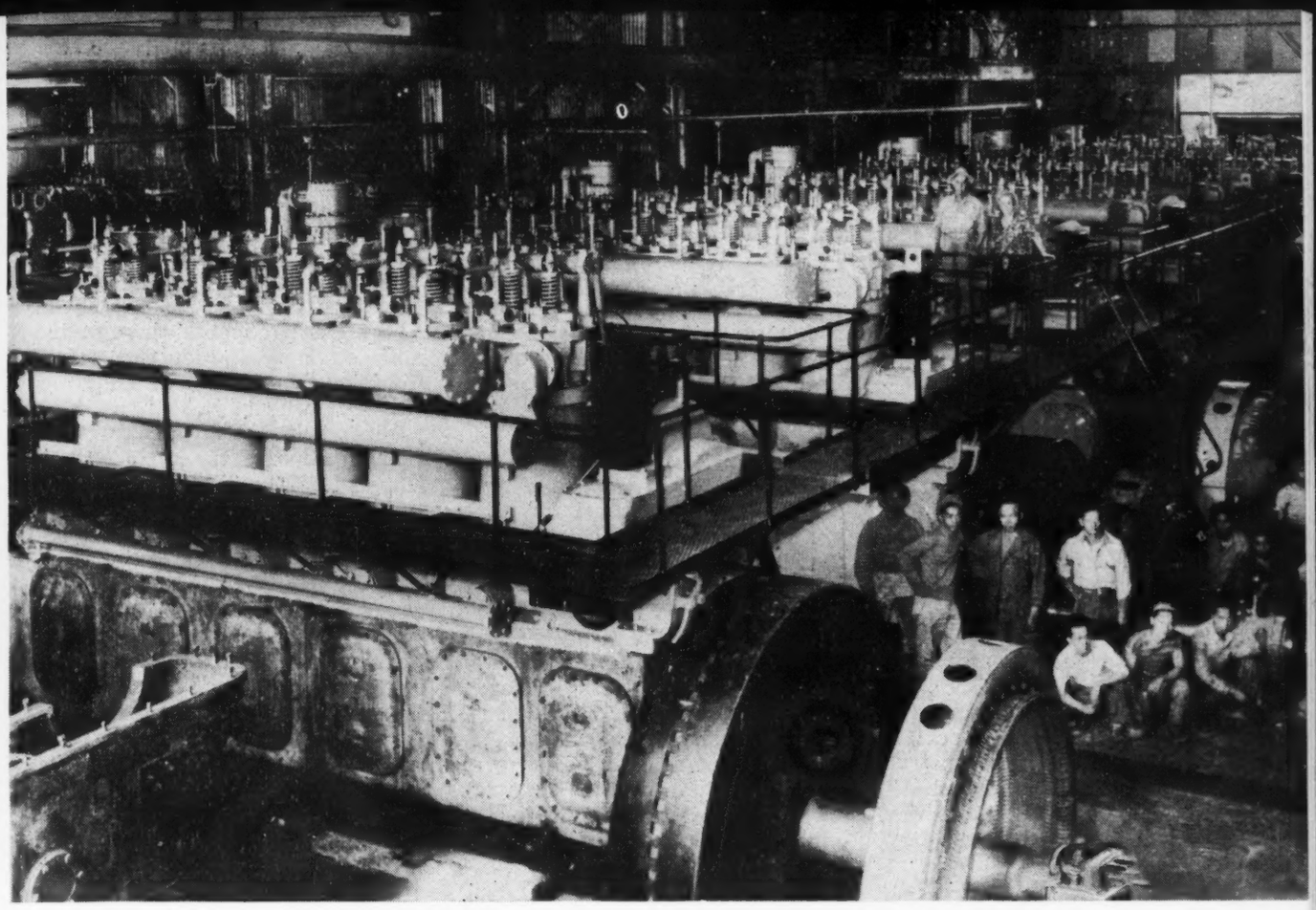


ONE OF THE GRINDING MILLS in the new Benguet-Balatoc mill.

REHABILITATION OF THE PHILIPPINE gold mining industry in 1947 was not as rapid nor as satisfactory as had been hoped, but definite progress was made. Only a few of the 33 mines that had a total prewar production of 1,130,000 oz. of gold in 1941 were back in operation, nearly three years after the date of the liberation of the Islands from Japanese control. More disturbing perhaps was the fact that some of the more important prewar producers had as yet made no effort to rehabilitate.

The mining companies that had courageously gone about rebuilding their ruined, or nearly ruined, plants and restoring the underground workings had been obliged to face discouragements that at times seemed unsurmountable.

*Chief valuation engineer, Philippine Bureau of Mines, 1938-1941.



DIESEL POWER PLANT, seen in part, in the new central Benguet-Balatoc mill.

the Philippines Progresses

These can be listed, not necessarily in order of importance, as lack of working capital, increased cost of labor and supplies, inability to obtain prompt delivery of equipment and machinery from the United States, and the political uncertainty attendant upon setting up a new government in the Philippines.

Those companies that were milling ore, or well on the road to doing so, in 1947 had started rehabilitation with certain advantages. Either through possession of known ore reserves of a grade better than average, which insured a profit even under higher postwar operating costs, or by having cash deposits in the United States before the war upon which they could draw, they could make definite plans for resumption of work and obtain aid from banks or stockholders with more assurance than marginal gold producers. Of the companies operating the five gold mines now in active production, Benguet Consolidated and Balatoc, controlled by the Haussermann interests, had adequate funds in the United States and also had obtained large-scale banking support for the ambitious reconstruction program started in June, 1945, and carried on continuously until the first ore was run through the new mill in the closing days of 1947. Atok Mining Co., which operated the Big Wedge mine in Baguio, was fortunate in finding its surface plant in better shape after the war than others in the same area, yet it exhausted its own cash resources in rehabilitation and was obliged to obtain more funds from its stockholders through issue of additional shares. The same procedure was followed by the Mindanao Mother Lode Mining Co. and by Surigao Consolidated, the two successful prewar gold mining operations in Mindanao. Lepanto Consolidated, scheduled to have its new copper-gold concentrator in operation by April, 1948, was fortunate in finding a large tonnage of copper concentrates at the mine that the Japanese had left behind when forced to abandon the property. Sale of these concentrates in the United States provided rehabilitation funds in large measure.

No financial assistance whatever has been received by any of the mining companies in the post-war period to date from payment of their claims by the Philippines War Damage Commission. The Commission chairman, Dr. Frank A. Waring, pointed out that, while full consideration should be given to the war-damage claims of business and industry, the law required that the Commission first pay in full up to $500 on approved claims of the smaller claimants before it can make larger payments on any other. As a result of the large number of small claims filed, it is doubtful if more than 25 or 30% of the face amount of the larger claims will be paid from the original grant by Congress. The date when even this minor amount will be paid is still uncertain, although it has been indicated that it may be this year.

While thus no criticism can be leveled against the Commission, it appears unfortunate that a more liberal policy was not adopted that would have speeded up rehabilitation work, increased employment, and provided larger gold exports to balance the present unfavorable

trade position of the Philippines.

Spokesmen for the important Marsman and Soriano mining interests, which control between them more than a dozen formerly productive gold mines, have stated plainly that payment of war-damage claims is necessary before they would undertake any large-scale rehabilitation work. Other reasons ascribed by them for their unwillingness to go ahead are the high labor costs and their dissatisfaction over the price of gold. In short, these companies declared that operation under present conditions would be uneconomic.

These considerations did not influence the companies that began rehabilitation after the war. The most extensive program was undertaken by Benguet Consolidated, which also controls the Balatoc mine. The management has stated that over $7,200,000 was spent on the work. This included construction of a new mill, to have an ultimate capacity of 4,000 tons per day, and a complete surface plant. During the year, two long haulage tunnels were completed, one to the Benguet workings, the other to Balatoc, totaling 14,469 ft. in length, at a cost of $24 per foot. Considerable savings are anticipated from central milling for both properties, instead of operating three mills as before the war.

During the year, a total of 48,000 ft. of drifts, crosscuts, and raises was retimbered and repaired at both mines. More than 2,000 men were employed. Although no attempt was made to develop new ore, in driving the Benguet tunnel some interesting veins were cut that have promise of developing important orebodies.

Reserves 4,000,000 Tons

A re-survey was made of the ore reserves. As of the year end, these were 1,515,268 tons of positive and probable ore in Benguet, averaging $11.36 per ton, and 2,422,796 tons in Balatoc, averaging $9.27 per ton. Total reserves had a gross value of over $31,200,000.

Construction of the new mill was hindered from the beginning by delays in shipping new equipment from the United States. Thus the actual date for operation was many months later than originally scheduled. The greatest ingenuity and resourcefulness of the operating staff were required to salvage and repair old equipment for temporary use until new machinery could arrive. The new mill, rated at 1,200 tons present capacity, is now doing very satisfactory work. Results for the first 15 days operation showed 92% recovery from $10 mill heads. J. S. Peterson, general manager, who was in charge of the Balatoc mine before the war, says the plant will do better than the former mills, and that it has already handled without any trouble some of the muddiest and wettest ore ever produced in the mine.

First to Resume

Big Wedge, operated by Atok, won the distinction of becoming the first large producer of gold in the postwar period in the Philippines, although Surigao Consolidated had started milling on a small scale some months earlier. Its 400-ton mill was put in operation in March, 1947, after more than a year of repair work on surface and in the mine. Tonnage milled increased steadily in the months that followed, and reached 12,500 in December, which is about the rated capacity. In the nine and one-half months the mill recovered $1,673,688 from 91,201 tons that averaged $18.30 per ton at the statutory price. Actually, it appears that revenue from bullion sold was substantially in excess of this figure, as some of its gold was flown to London for sale at a higher price before the monetary authorities cracked down on such transactions. Later, the company received prices for the metal varying from $40 to $47 per ounce in the local gold market in Manila.

Reopening the Big Wedge after the long shutdown was difficult. During the latter part of 1941, the ore had been hoisted from Nos. 1 and 2 Keystone shafts, but the first had hopelessly caved and No. 3 had to be started. The high cost of mine timber, caved stopes, and high-grading that had gone on during the war years made rehabilitation slow and costly. Top slicing was tried when mining was resumed in 1947, but was not satisfactory and the management went back to square sets. Little new exploration work was done during the year, but there appear to be good possibilities of finding other ore shoots west of No. 2 shaft along the general strike of the Keystone vein, and a chance of finding a new vein at depth south of the Keystone. In any event, thanks to the large tonnage of good ore exposed in 1940-41, which is still virtually intact, the mill is assured of an adequate supply of ore for some years to come. Tentative plans have been made to double the mill capacity.

During most of 1947, Surigao Consolidated in northern Mindanao milled low-grade ore from its surface pit. On account of limited settling and filtering capacity it was unable to put more than 4,000 to 6,000 tons per month through the mill. From this production, somewhat less than $50,000 monthly was realized, which yielded a small profit to help defray the expense of rehabilitation of the surface plant and underground workings. Near the end of the year a limited tonnage of better-grade ore was obtained from the 200-level workings.

Unwatering the mine was arduous work. Although it was expected that most of the openings would be caved after the long shutdown, this did not appear to be so as work proceeded. When the main shaft, located outside of the orebody, was pumped out, the timbers were found in excellent shape except where cracked by heavy ground.

The management plans to start cleaning out the 400 level as soon as possible and immediately thereafter to sink to the 500 and 600 levels and defer mining the lower-grade ore on the upper levels until costs are stabilized.

Approximately half of the values recovered in the mill are being shipped to the United States as table and flotation concentrates. The other half is recovered as bullion. This is sold locally in Manila.

Another Surigao mine, the Mindanao Mother Lode, entered the producing column in August with ore obtained from a small ore shoot on the No. 50 vein above the water level. At the same time, the lower levels of the old mine were being pumped out to reach the stopes on the 540 and 700 levels. The water level was lowered at a rate of 7 ft. per day, 2,000 g.p.m. being handled with specially designed pumps. The 400 and 540 levels were in good condition when unwatered. In October, a limited tonnage from the 540 level was sent to the mill. It realized about $35,500. In November, the mill took 1,900 tons, averaging $30 per ton, for a production of $87,000.

Mill Run Intermittently

The new flotation plant has a proven capacity of 250 tons per day but operated only intermittently during the later months of the year as ore was available. Metallurgical results have been good. The new

diesel plant consists of two 850-hp. engines and has been in operation since August. Resumption of sinking in the No. 2 shaft is planned for early in 1948.

Reports confirm the presence of extraordinarily rich ore on the 700 level of the Tabon-Tabon vein. In 1941 this vein yielded the highest grade ore milled by any mine in the Islands. During the year a new vein was uncovered east of the main structure that shows encouraging values on surface.

Dredging Restarted

Two gold dredges started work successfully in 1947 in the Surigao area. The Tambis dredge, a small prewar bucket-line operation, recovered $7,500 a month regularly. Another dragline dredge was at work on the Cansuran river below the old hydraulicking grounds of the North Mindanao company, and is reported to be doing well under experienced operators. No attempt was made to rehabilitate the large Coco Grove gold dredges in the Paracale field.

The Antipolo mine, which had just completed building a new 75-ton cyanide mill on its property, about 70 km. south of Manila, when the war broke out, was taken over by Soriano interests and put in production late in the year. It was unwatered to the 300 level and some excellent ore was found in the new winze sunk to the 400. Immediate plans call for sinking to the 500 level and diamond drilling there to prospect for parallel structures. If further development work confirms the good results already obtained on this property, it may augur the opening up of a new gold mining area, as the Antipolo thus far is the only mine in this section.

While Lepanto Consolidated is generally classed as a copper mine, the ore also contains considerable gold which is recovered as a by-product. Undoubtedly the mine will contribute substantially to the gold output of the Philippines in 1948. Rehabilitation in 1947 consisted of rebuilding the 500-ton flotation mill, scheduled to be in operation in April, 1948. The condition of the underground workings after the Japanese had left was unusually good and production could start almost immediately from the stopes. Improvements were made in handling ore between the mine and the new mill by driving a tunnel from the old Benguet level to the crushing station, from which the ore will be conveyed to the 1,000-ton mill tank. Present plans do not include rebuilding the smelter which made a matte product for shipment in 1941, and all concentrates produced will be sent to the United States for smelting.

The value of the gold production in the Philippines for the first six months of 1947 was estimated by the Bureau of Mines at $677,700. For the full year it probably exceeded $2,400,000, indicating a 250% increase in the last half, due largely to the expanded production of the Big Wedge.

In 1948, the gold output of the Islands will exceed $10,500,000, based on probable production by the mines now in operation. No great increase in this figure is likely before 1949. Even if rehabilitation of the Marsman and Soriano properties began in 1948, they would hardly be able to produce for another year. On the other hand, if Benguet and Balatoc increased their output to the proposed 4,000 tons per day, the figure mentioned would be much exceeded, because the prewar value of the production for both mines was over $13,000,000.

Chrome Mines Producing

Before the war, the Philippine Islands were shipping large tonnages of chrome, manganese and iron ores abroad. Iron ore went exclusively to Japan, which provided the only market. Until conditions permit the resumption of former business relations with that country, there is small possibility of any rehabilitation of the iron mines which are still remaining idle.

The picture has been different for the chromite and manganese mines in 1947. Benguet Consolidated, which operates the huge Masinloc deposit of refractory-grade chromite in Zambales on a profit-sharing basis, maintained a steady production from the mine during the year. Until interrupted by heavy typhoons during the later months, which did considerable damage to the pier and disrupted shipping schedules, a steady stream of freighters called at the loading port for shipment of the ore to buyers in Philadelphia and Baltimore. Some shipments were also made to European ports. According to an official statement, the mine shipped 187,500 tons of manganese on 58 ships during the year to the United States.

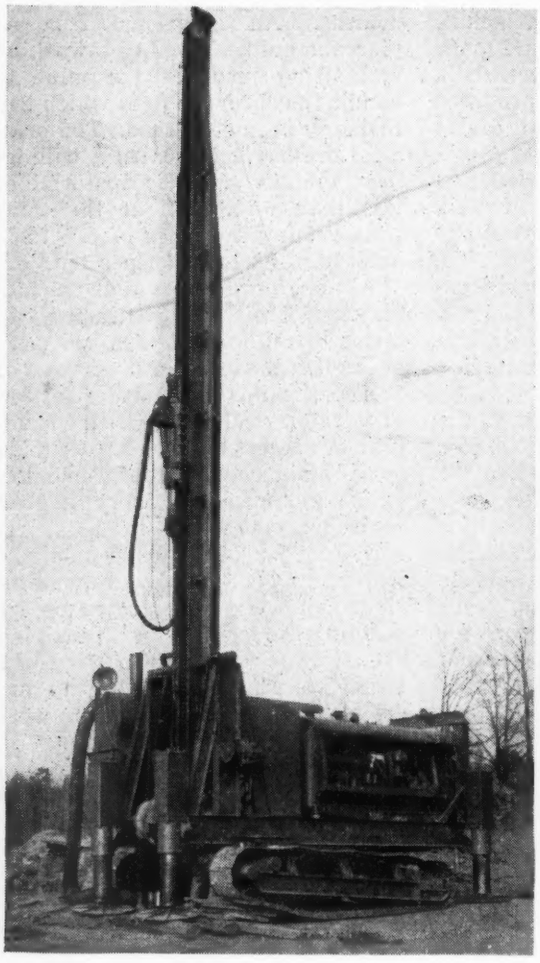
Labor relations, which had been troublesome at the property early in the year, improved in the latter months. An additional concrete pier was built, as well as a washing and sizing plant at the mine to handle the chromite fines which had formerly been discarded. The principal ore-buyer indicated a willingness to take screened material of less than 6-in. size, at the same time raising the price of ore f.o.b. ship from $8 to $9.50 per ton.

Although ore reserves at the Masinloc deposit are estimated in terms of millions of tons, company geologists made careful surveys of adjacent claims in Zambales for ore of metallurgical grade, with considerable success. The Acoje mine some distance north of Masinloc, which was a large shipper of good grade chromite ore in 1941, received a loan of $750,000 from the Philippine R.F.C. for rehabilitation, and work was started on rebuilding the loading pier, repairing the storage bins and putting the road into shape for trucking ore from the mine. No shipments were made in 1947.

In the new chromite-mining area near Cagayan, northwestern Mindanao, shipments of good ore were made by Luzon Stevedoring Co. from its property at Opol. International Engineering, controlled by the Soriano interests, started construction of a road to new chromite deposits about 30 km. from the coast. Shipments are expected early in 1948. Engineers representing important American mining interests were active in examining new properties.

Busuanga Ships Manganese

Manganese mining in 1947 was confined chiefly to Busuanga Island, one of the Palawan group, from deposits controlled by the Luzon Stevedoring Co. Considerable work in the same area was done by the Palawan Mining Co., which has exposed over 1,500 tons of ore on the property with a much larger additional tonnage indicated. The Bay-Bay Manganese Co., operating in Leyte, developed a large tonnage of ore of good grade (about 48%) and was favorably reported upon by government engineers. Considerable damage was done to the company's loading pier in the December typhoon and shipments have been suspended until it is repaired. Shortage of freighters, higher operating costs, and lack of working capital have handicapped the smaller manganese mining concerns, but apparently more interest is being taken in this ore than in the years before the war.



PISTON-TYPE AIR DRILL attached to roller chain passing over tower has just been raised to working position. Note the leveling jacks. At left of tower is the dust-collecting equipment. Right, CLOSE-UP OF DRILL BIT and rod held above dust-collecting hood over hole. Roller chain is seen behind the drill rod. At right and left, a leveling jack.

For Faster Drilling

A NEW MACHINE for drilling blast holes up to 6 in. in diameter and as much as 70 ft. in depth in stripping work, open-cut mines and quarries, and doing it faster, according to the manufacturer, than any conventional machine in current use, was demonstrated recently at its Phillipsburg plant by the Ingersoll-Rand Co., which developed it. It is known as the Quarrymaster. The machine, which is mounted on crawlers, is a completely self-contained, rock-drilling unit, including an air drill, compressor plant, propulsion equipment, and auxiliaries.

Some Performance Figures

On the day of the demonstration at Phillipsburg, 47 ft. of 6-in. hole was drilled in hard blue limestone in 3 hr. 29 min. net time or 13.4 ft. per hour. Previously, in drilling in taconite at Babbitt on the Mesabi Range, at minus 40° F., every bit was broken, despite which 8 ft. of hole per hour was scored, as against 1.5 ft. per hour in taconite with a churn drill. In soft shale in Pennsylvania, up to 40 ft. of hole per hour was drilled. On the average, the new machine, using conventional bits, is said to have given about 50% more footage than a churn drill.

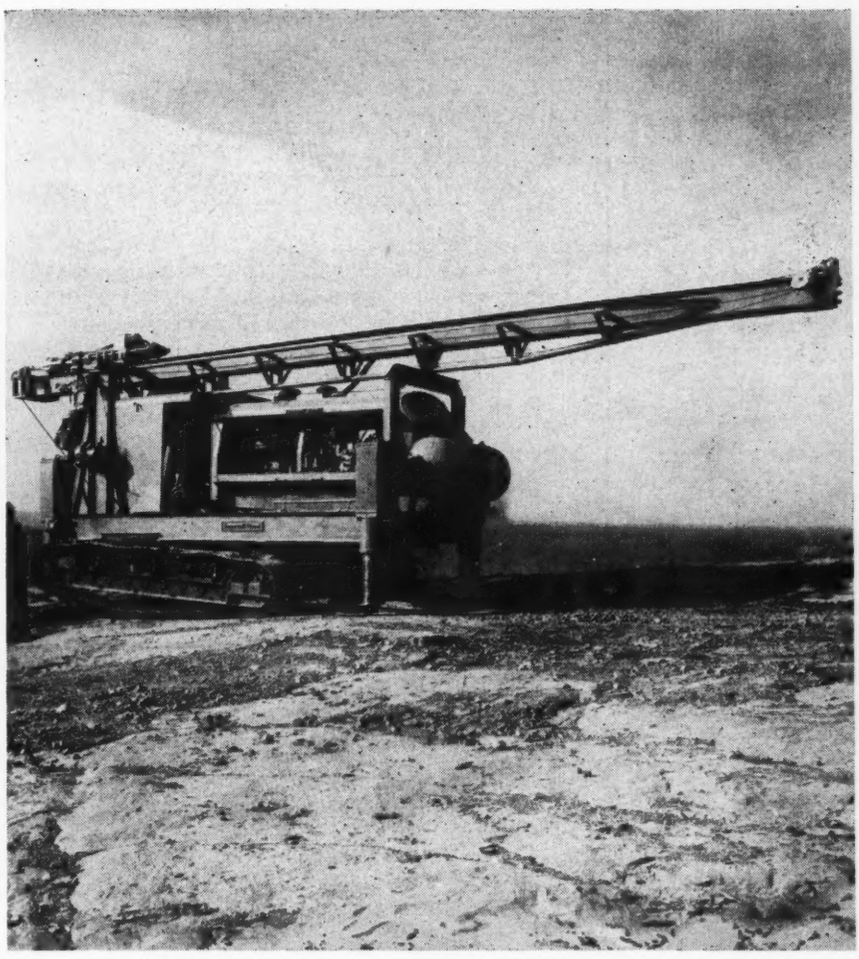
Actual savings in power are not so great but the saving in labor is said to be important. With the new machine, better fragmentation with a saving in secondary drilling and blasting can be obtained, the manufacturer believes, through its ability to put down more 6-in. holes at closer spacing as compared with a smaller number of more-widely-spaced holes.

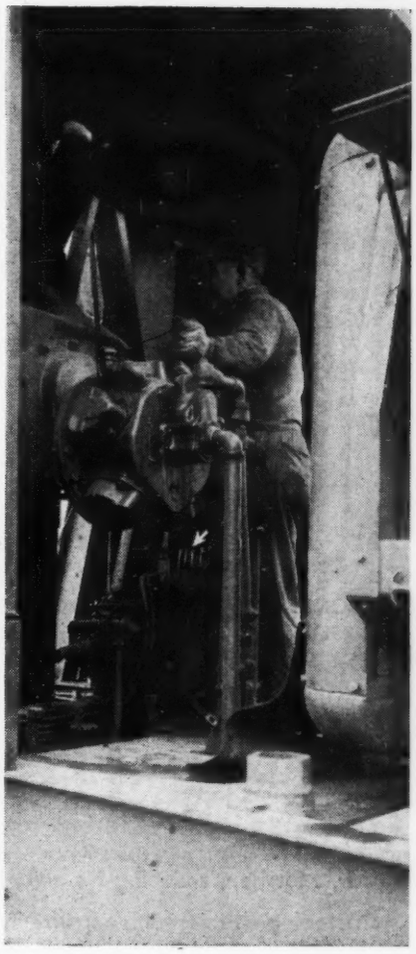
The air drill used on the Quarrymaster is of the piston type, the rod and bit reciprocating with the piston, and strikes 200 blows per minute. It is carried on the face of a welded steel tower or guide, and is fed up or down, together with the attached drill rod and bit, by a 2½-in. single roller chain attached to the drill cylinder. The chain passes over a sprocket at the top of the tower and down to the guide rollers and over the sprocket of the driving feed motor. This feed motor is air-operated and can lift 16 tons. Once regulated, the feed rate need not be altered unless drilling conditions change materially.

Power Cycle Efficient

The drill itself has a patented valve action and works on a power cycle devised for efficiency and speed. The stroke is adjustable.

The feed motor also serves for raising or lowering the tower, using





DRILL WITH TOWER LOWERED. The tower can be raised quickly using power of feed motor. The machine can be moved from hole to hole and set up quickly with the air of the leveling jacks. Right, CONTROLS are conveniently centralized in cab. Note the four valves for leveling jacks, indicated by the arrow. Thus drilling is facilitated.

# of Surface Blast Holes

a ¾-in. cable to accomplish this.

Each crawler track has its own reversible air motor. The two have enough power to permit a propelling speed of a little over 1 mph. on level ground and to negotiate a 30% grade.

The machine's compressor is of 500 cfm. capacity and is driven by a diesel engine as in the one illustrated, or by an electric motor.

Four hydraulic leveling jacks are provided, one at each corner of the frame. Each is worked by a valve, the four valves being located, for convenience, at the operator's station in the cab. The machine can be leveled quickly by these means.

Several Advantages

Based on these and other construction features, four outstanding advantages are claimed for the new machine. They are: (1) Faster drilling. (2) Controlled power feed. (3) Automatic rotation. (4) Continuous hole cleaning.

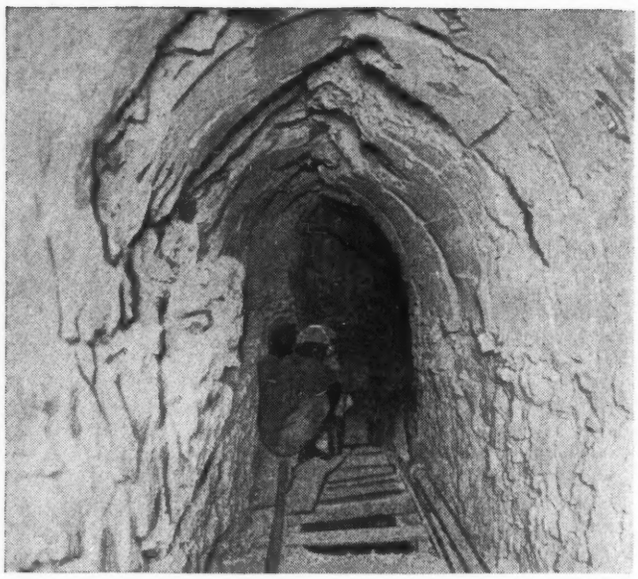
Rapid Drilling and Why

The unusually high rate of rock penetration is said to be obtained by reason of certain contributing factors. These are: The drill's speed is more than 200 blows per minute. The bits used, which are of the well type, are light, long-wearing, and easily changed. Some test work has been done with two specially-made Carset (tungsten-carbide) bits but it is purely experimental as yet. Accurate control of the feed rate by the operator through a convenient throttle on the air motor which drives the feed chain, helps in drilling through slips and seams where close regulation is necessary. A drill-steel centralizer facilitates collaring.

No water is used in drilling, moreover, an advantage in freezing weather. Automatic rotation of the bit, done on the up-stroke, turns it into a new cutting position for each blow. The amount of rotation is controlled so that the cutting is done with maximum efficiency. Thus, the manufacturer points out, the drill is a rock-cutting machine rather than a crushing machine. A clean surface is provided for each blow by forcing cuttings to surface with the drill's exhaust air through the space between rod and wall of hole. At the collar, these cuttings are sucked into a motor-operated dust collector.

A Portable Power Plant

The new machine is more than a drill. Substantially, it is a portable self-propelled compressed-air plant, and can be used as such on occasion.



MASONRY AND CONCRETE-LINED LEVEL with concrete ribs above and below for depth approximating stope width.

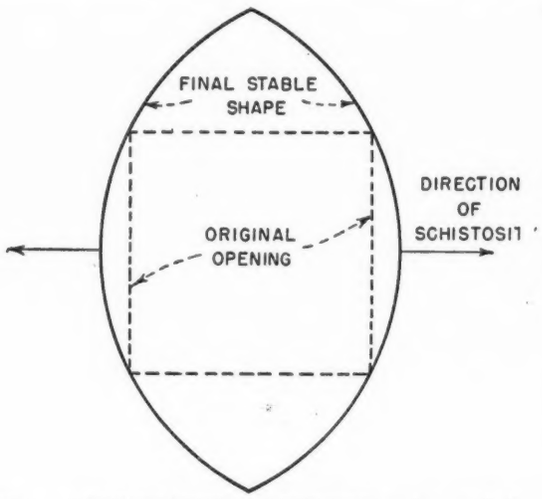
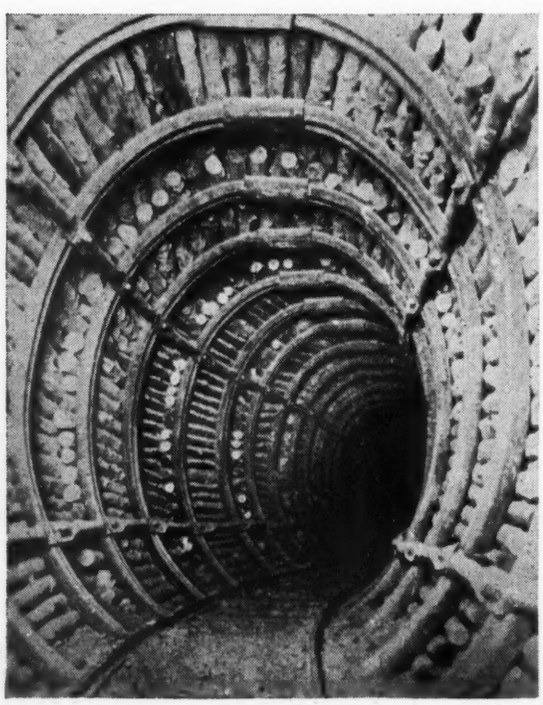


FIG. 1. A SQUARE VERTICAL OPENING, such as a shaft or winze, in steeply dipping, hard but schistose ground, tends to work to this characteristic shape (diagrammatic).

Theory and the Practical

Mr. Morrison, reducing his conclusions to simple proportions, finds that if stoping can be done on retreat, the requirements of level maintenance and stope support are at a minimum. If retreating is not possible, a yielding but resistant type of support in maximum volume should follow the working face as closely as possible. Other openings should be disposed with regard to the ultimate stress pattern which will develop with stoping.

R. G. K. MORRISON
Superintendent
Nundydroog Mines, Ltd.
Oorgaum, Mysore
South India



A STEEL-SETTED LEVEL. Discarded, double-headed, 75-lb. rails are used. Right—THE SETS here are of H-beams weighing 18 lb. per foot.

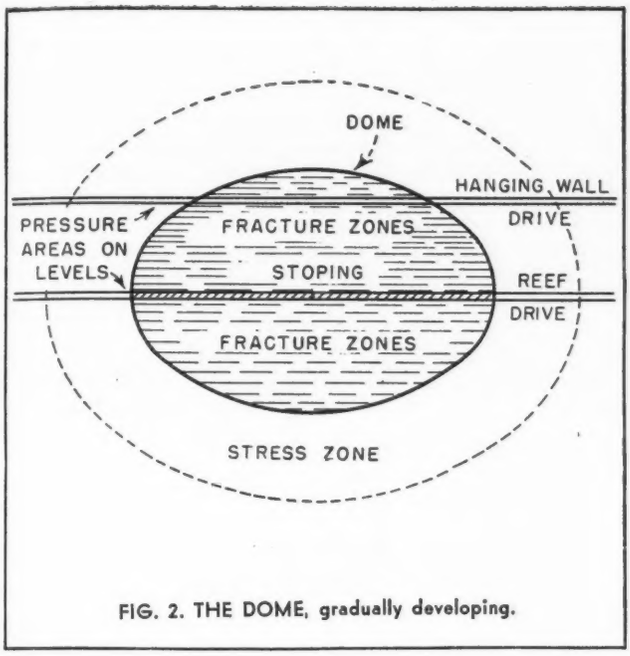


FIG. 2. THE DOME, gradually developing.

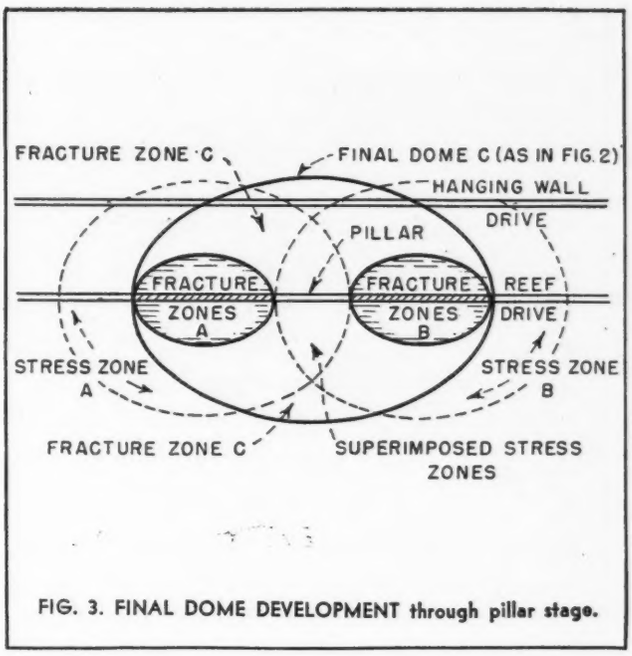


FIG. 3. FINAL DOME DEVELOPMENT through pillar stage.

Problem of Rock Bursts

EXCEPT FOR SUPPORT and such control as we may exert over the effect of planes of weakness, there is no known solution for rock bursts resulting from the presence of a single stress zone, as I pointed out in the article published in *E. & M. J.*, in December, 1947 and the following issue. Such rock bursts appear to be the inevitable consequence of making the excavation. Close support of the right type in some cases will greatly reduce accidents. Intermittent working of such points may also reduce risks, though not necessarily in the proportion which the unworked period bears to the working period, as there is occasionally the suggestion of a trigger effect precipitating such bursts. With the uncertainties pertaining, we are fortunate indeed that violent bursting of this nature is on the whole rather unusual.

Rock bursts resulting from planes of weakness and superimposed stress zones are more common and usually more violent and, by the same token, more amenable to treatment.

The general theory outlined in the preceding article suggests that, up to an infinite distance, any opening occurring at depth may influence the stress pattern of any other opening.

It is difficult to assign an absolute value to the safe distance between two openings, as several variables enter the problem. Theory suggests that if the distance exceeds one half of the combined breadth of each, the influence of one stress zone upon the other will be small. The safe distance is also subject to ground characteristics and the condition existing as regards arching stresses within the domes, and arching stresses increase with both the development of the domes and the nature of support. For large, well-supported stoping areas, separated from each other by a distance approximately one quarter of their combined breadth, visible indications of superimposed stress zones should not be conspicuous; while for two small unsupported openings with schistose ground between, at a distance of one half their combined breadths, the effect is likely to be very obvious.

The Problem of Pressure

There are advantages in considering the general problem of pressure under the following headings: 1. Shafts. 2. Levels. 3. Stopes.

Shafts. The rectangular, timbered, vertical shaft is standard practice the world over for the first few thousand feet in depth, and while this type of shaft has given good service to depths of the order of 7,000 ft., maintenance under pressure conditions becomes extremely expensive and rock bursts are a very serious consideration.

When mines reach a depth where ground pressure is a factor, ventilation will also have become an important problem. With the combined requirement of both ventilation and ground pressure, the economic balance at some stage will swing toward the monolithic concrete lining, or to the brick-lined shaft with steel equipment.

The timbered, vertical shaft through varying ground is too well known to require comment here, so except where references could apply to either, this article will deal with the steel-equipped, lined shaft, which I regard as most suitable for deep mining.

As described in an earlier article, an opening in ground under pressure tends to work itself to a characteristic shape. In the Kolar gold field, with a steeply dipping, schistose structure, a shaft or winze, regardless of the shape to which it is cut, tends to assume the characteristics shown in Fig. 1.

As this shape represents the natural adjustment to existing pressure, it follows that, if the shaft section approximates it, the lining of brick or concrete will be subjected to less pressure in maintaining local stability under mild variations in the stress pattern.

The circular shaft, giving the greatest effective ventilation area, has enjoyed widespread accepta-

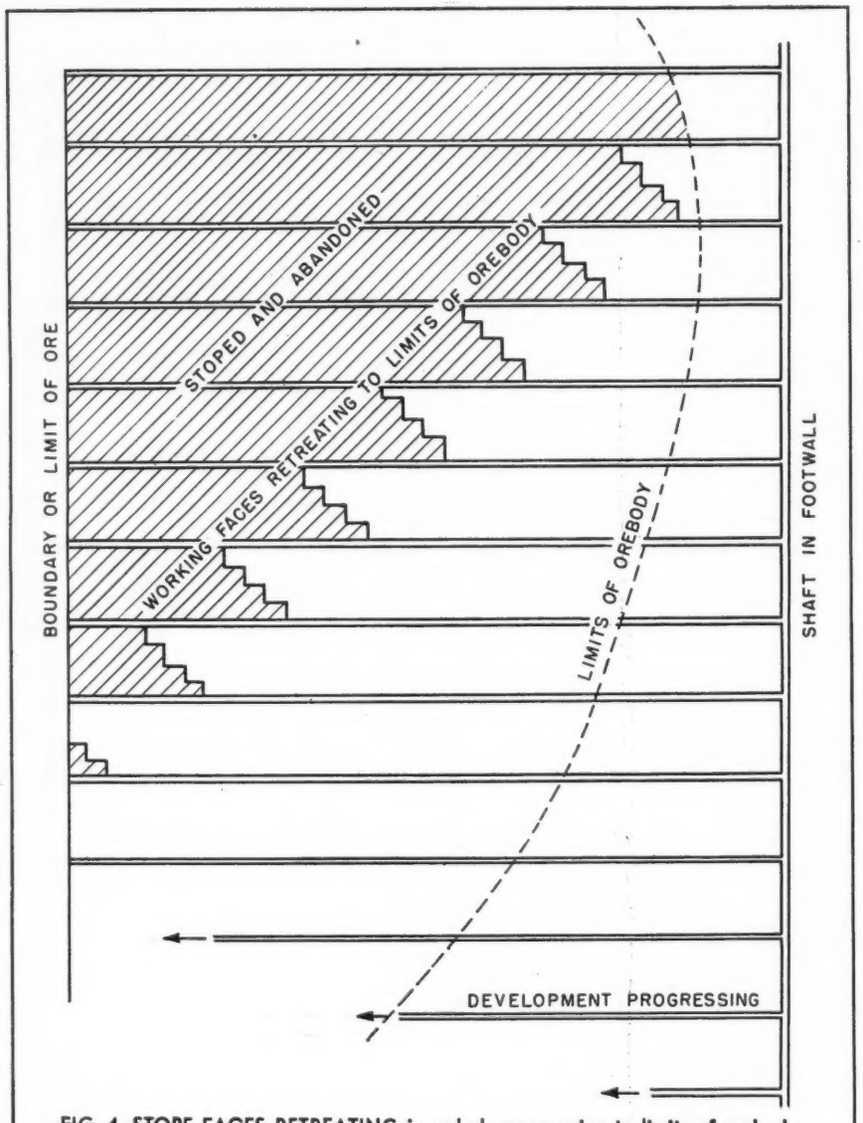


FIG. 4. STOPE FACES RETREATING in orderly progression to limits of orebody.

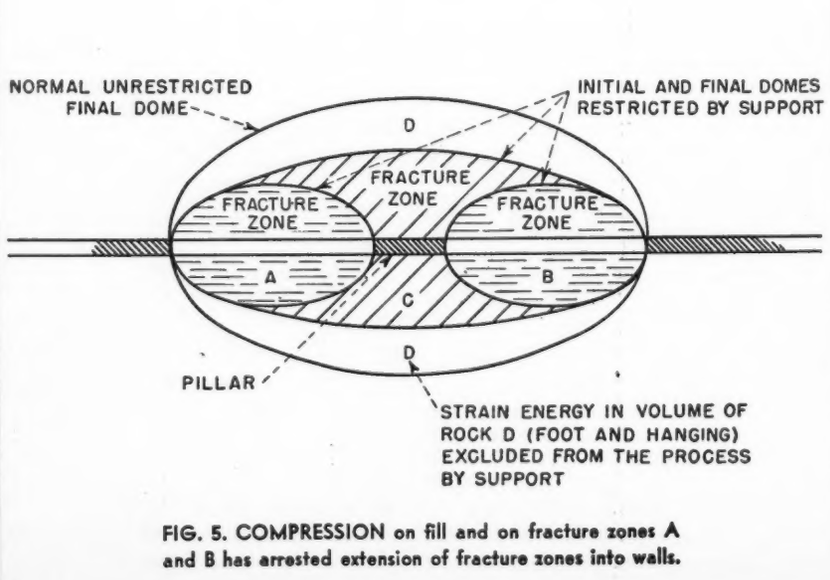


FIG. 5. COMPRESSION on fill and on fracture zones A and B has arrested extension of fracture zones into walls.

bility and stands up well under both gradual pressure and rock bursts. However, in ground which arches as in Fig. 1, at sufficient depth pressure-resistance conditions do develop where the lining works itself in a direction normal to the schistosity, indicating that the ellipse would be the more stable form.

Selecting Shaft Site

Thus the shape of the shaft depends on local ground conditions. Once it is established, the selection of the site remains. In deep mines with steeply dipping orebodies, if it is not possible to pass through the lode line in a barren area, the possibility of losing a badly located shaft, or tying up a prohibitive quantity of ore as a pillar, more than justifies any extra crosscutting required in the selection of a footwall site. The actual position will then be dependent on the location of present and future stress zones and known planes of weakness, as well as the operational facilities required by the mine. If it is possible to lay out a shaft to permit the maximum amount of stoping on a retreating basis, this advantage should never be overlooked.

Unfortunately, with deep mines that continue over generations, the problem is not quite so simple, as the layout has frequently been decided upon years before and the miner is left to make the best of the conditions he has inherited. These conditions usually take the form of a shaft in the hanging or footwall of a stoping area or a shaft protected by a pillar.

Pressure problems in hanging or footwall shafts are related to the influence of stope stress zones in the vicinity. With the effect of gravity acting with the stope stress zone in the hanging, but against it in the footwall, it follows, other things being equal, that footwall stresses are of a lower order and openings there correspondingly safer.

Effect of Shaft Pillars

If stoping over or behind a shaft is essential, pressure effects are inevitable within a certain range. However, with sufficient exceptions to preclude any suggestion of absolute security, I have found that, if such stoping takes the form of a regular and even progression of faces, there is a good chance that the reaction in the shaft will be gradual, a condition which, with

some reduction in shaft capacity, can be dealt with. On the other hand, if pillars are involved in the process, the risk of rock bursts is greatly increased.

The shaft stress zone is small and the even progression of stope faces involves the passage over it of a single major stress zone, while with pillars a different and more concentrated stress arrangement is involved. (In Figs. 2 and 3 substitute a shaft for the hanging-wall level.)

Any adjustment to an increase in stress is, in the first instance, at the expense of the opening concerned, in this case the shaft. Increased stress means greater compression within the elastic limit, and the cumulative effect on the rock surrounding the dome is to force more ground, through gradual failure in shear, into the shaft fracture zone, thus bringing pressure on the shaft lining. The rock burst occurs when some combination of weaknesses in the path of this process offers an opportunity for sudden, rather than gradual, adjustment. The chances of this happening are greatly increased by expanding the super-stressed volume of rock, which inevitably follows with the stress concentration associated with pillars. This generalization will hold for any combination of openings.

Pillars a Special Problem

The shaft protected by a pillar is a case in point. The intensity of the stress pattern surrounding the shaft is related to the effects of at least two major stress zones and thus depends on the size of the pillar.

Shaft pillars are undesirable in deep mining, but in many cases are unavoidable and, in others, are a heritage of the past. Rules that have been laid down for the safe size of such pillars vary[1] widely. The size, in addition to depth, depends on ground conditions as well as the extent of surrounding excavations. Thus uncertainty is associated with any estimate. With the extensive stoping areas of the Witwatersrand, it is not uncommon to have shaft pillars of the order of 1,200-ft. diameter to protect vertical shafts intersecting the reef at depths of 4,000 to 5,000 ft. However, shaft pillars are a special problem and it is sufficient for this article to point out that they are an outstanding example of the risks associated with superimposed stress zones and, through large stoping areas, have been responsible for some of our heavier bursts.

Inclined shafts with few exceptions require that the long axis be parallel to the orebody, and, under conditions shown in Fig. 1, stoping strains on such a section can make maintenance rather difficult.

Timbered inclines also have been used to great depth, but where varying stresses are likely to be encountered, masonry side walls supporting a brick or concrete arch over the back have been found effective. With a long shaft section, a timber-cushioned masonry or concrete wall down the center can be even more effective.

However, like all other openings, stress conditions can develop which no type of lining will withstand.

Levels Present Problem

Levels. Maintenance of levels through stoped ground under pressure is one of the major problems of deep mining, as both gradual pressure and rock bursts have to be provided for.

With stoping widths up to, say, 10 ft., the easing of sets and retimbering required becomes a very costly matter. Where orebodies are large, gradual pressure, to say nothing of rock bursts, may require retimbering of the levels several times over the life of the area.

The problem is modified somewhat in favor of well-filled or supported stopes, as compared with less support in open-stope methods. With large orebodies, however, the squeeze, which even the best filling or support permits, leaves little room for optimism as regards the ultimate effect on levels.

The most satisfactory alternative is a stoping sequence that permits abandonment of levels as the ground is removed. The recommendation is based on experience and not on theory and is qualified only by the cost factors entering any particular problem. If the orebody is large, there is every justification for retreating methods.

Where levels have to be maintained, and there are always such cases, timber sets have proved ineffective under rock-burst conditions.

The conception of well-filled stopes and levels protected back and bottom with concrete ribs for depths proportional to the stope width has been tried out. The level itself was masonry-walled and arched over with concrete up to the top rib. The results, shown in the first picture, were disappointing. The concrete cracked up under gradual pressure and, in the event of a rock burst, it became definitely dangerous.

It can be argued that a greater percentage of support in the form of concrete ribs might have achieved more satisfactory results, but here it is well to keep in mind the main objective, which is the removal of the ore, rather than only the maintenance of levels. An increasing percentage of concrete fill will soon swing the cost factor toward other alternatives.

The most satisfactory level support is the steel set which yields under pressure, but at the same time maintains an opening. An illustration shows the use of discarded, double-headed, 75-lb. rails for this purpose. This setting became standard practice in the Kolar mines until war conditions removed such rails from the market. Various steel sections are now being tried. Another picture shows sets protecting a development end that are built of H-beams 5x4½-in. in cross section and weighing 18 lb. per foot.

Steel setting is expensive, but against this must be balanced the fact that, in the event of rock bursts, it offers greater assurance of a traveling way being passable than any other type of support known.

Levels in Wide Orebodies

In wide orebodies, the proportion of squeeze directed on the level is less and, although the effects of pressure on sills and crown pillars is a factor, the problem of levels is more merged with that of stope support, and timber in the form of cribs or caps and posts clear of side pressure still has a place.

Applying the conception of stress zones already presented, Fig. 2 illustrates the relationship between a stoping stress zone and a level (or any other opening) in the foot wall or banging wall.

Continued stoping extends the stress zone over the level with increasing intensity until, with the extension of the dome, the level is gradually brought within the fracture zone. While the possibility of minor bursting exists throughout, the process is usually gradual enough to be capable of control.

On the other hand, with pillars involved as in Fig. 3, a similar condition is reached, the energy from rock within the final fracture zones being released in quite a different sequence. With two stoping

[1]Peele's "Mining Engineers Handbook." Shaft Pillars.

areas and a pillar between, each develops its own fracture zone, dome and stress zone, the pillar forming common ground for both stress zones. With the extension of stoping or reduction in size of the pillar, the heaviest stress on the level is usually indicated immediately over the pillar (superimposed stress area). With the failure or removal of the pillar, the final dome with its fracture zone, including a portion of the level, forms over the whole area, and a condition similar to that shown in Fig. 2 is thus arrived at. In each case, the energy liberated in the process is that released by confined rock on transfer to the fracture zones. In Fig. 2, no obstruction is placed in the way of the gradual process, while in Fig. 3 the pillar does obstruct it and any sudden failure will be reflected as a rock burst in both levels throughout the entire pillar area.

When Stoping Enters Ground Pressure Zone

Stopes. The early history of most deep orebodies is that of methods of mining, perfectly satisfactory for say the first 1,500 ft. of vertical depth, being carried into the ground-pressure zone.

Such methods were usually based on the development of an orebody by levels spaced 100 to 150 ft., with the ore between either stoped up to floor sills or divided into blocks 200 to 300 ft. long by raises or winzes, each block being stoped as an independent unit. Stoping, level to level, or block to block, was seldom coordinated, with the result that sills and pillars were formed indiscriminately. With the appearance of ground pressure, the consequence, in terms of rock bursts, usually was occasional rock bursts on individual faces increasing in frequency as the pillar stage was reached in any particular section, until a substantial area of ground was opened, rigidly supported by pillars of various sizes and shapes. At this stage, both the frequency and intensity of the rock bursts increased, and as a result of either a single major burst or a series of very heavy bursts, large stoping areas were rendered inaccessible and unproductive. If the ore remaining in the area justified reclamation, the process was both long and costly, and the final rate of production limited.

Of the major hard-rock mining areas afflicted with rock bursts, the Michigan Copper Country was the first to exhibit radical departure from previous methods. Here, with fairly continuous and extensive orebodies, the effects of pressure made it quite obvious that the grade of ore could hardly compete with the rising costs of stope support and level maintenance. The result was that many mines reversed their previous practice of advancing from the shaft, with the main support largely in the form of rigid pillars, to retreating methods.

With the latter methods,[2] stoping began at the boundary or half way between shafts and worked back in a stepped sequence of faces to a shaft pillar. Support was limited to that required at the working face and the hanging wall caved on abandoned levels well behind stoping operations. Such methods, Fig. 4, are both practically and theoretically sound and have been developed to the point where operators in other parts of the world can advantageously take note of them, and particularly operators who, while complaining of the ravages of rock bursts, still feel justified in reducing blocks to pillars at depth.

In other mining areas, greater irregularity in ore disposition, mine layout and the demands of production, complicated the issue somewhat and two points of view arose.

One school followed a very similar line of thought. Eliminate the need for pillars, keep the stope faces in an orderly sequence working towards the solid or a final pillar, and, even though levels had to be maintained, any trouble would more likely be gradual than happen as rock bursts.

The other school of thought, in a measure confusing effect with cause, associated rock bursts with the sagging hanging wall, and argued that, if this could be restrained by support, rock bursts would be eliminated.

All Support Methods Prove Disappointing

Both ideas have now been subjected to many years of trial and it is my opinion that no method of support varying from unit types, such as filled cribbing, timber packs and walling, to the most effective, complete fill, has demonstrated any marked ability to reduce the incidence of rock bursts. On the other hand, the orderly sequence of stoping, in eliminating sills and pillars and thus reducing the stress concentrations which lead to rock bursts, can be said to have been very successful.

While the rocks associated with coal measures vary widely in elastic behavior from the igneous rocks more common with metal mining, operating factors along with pressure conditions, varying only in degree, were responsible for the introduction of longwalling methods in that industry, where their success also warrants some consideration by deep metal mines subject to rock-burst conditions.

Why Success Follows Orderly Stoping Sequence

The reasons for the greater success attained with orderly stoping sequences would appear to be as follows:

If ground is given a chance to respond gradually to pressure, it will do so, more often than not. Opening up a stoping area in a manner that permits the development of a single fracture zone and dome with the related stress zone, places the solid rock surrounding the area under a stress pattern of the lowest possible order. Such superimposing of stress zones as may occur is confined to the comparatively small volume of rock associated with the stress zone of a level or similar opening when enveloped by the major stress zone of the stoping area. While in this process minor rock bursts may occur, more often than not, a somewhat accelerated but still gradual failure will be apparent.

The concentration of stresses through a substantial volume of rock, such as occurs when pillars of one type or another are involved, cannot arise. This condition is the greatest single cause of rock bursts.

From the point of view of support, it must be admitted that, if wall closure could be absolutely precluded, rock bursts also would be eliminated. This, however, appears to be even a theoretical impossibility.

Except at a very late stage in the case of fill, or over limited spans in the case of unit types, support does not stop wall closure, though the right type can exercise considerable control over the process.

A state of equilibrium existed before stoping began, which required rock in the confined state to maintain it. With the removal of that balance by stoping, a stress zone inevitably develops to replace it, and, once there is a stress zone, rock bursts become a possibility.

[2]Bulletin 306, U. S. Bureau of Mines, "Mining Methods and Practice in the Michigan Copper Mines." By W. R. Crane.

The stress zone develops as a zone of compression, the function of which is to maintain equilibrium in the confined rock behind it. The dome, defined earlier as the surface or zone separating the fracture zone from the confined state, adjusts itself with each enlargement of the stoping area. This takes the form of a slight, relative contraction within the elastic limit, in the course of which more rock is sheared into the fracture zone. This dome contraction, perhaps undetectable at any time, cumulatively can amount to inches, and as only confined rock or its equivalent can completely resist the movement, supports when subjected to it must, in resisting, either yield or fail, and rigidity at this stage will result in failure. The dome must be regarded as a huge crusher that can be choked only by forces equal and opposite to those inducing it, that is, confining pressure or its equivalent.

Where Structure Permits

With no structural complications, stulls and head boards (squeeze blocks) are perhaps adequate support to take a short stope through from level to level at, say, 7,000 ft. vertical. Increase the stoping span, however, and the inadequacy of such support will shortly be apparent. Given sufficient stoping span, a similar result will follow with any unit type system of support unless it is continuously able to yield without destruction to the elastic contraction of the dome upon the fracture zone.

While, in sufficient volume, a very sturdy unit-type support capable of yielding without destruction to superior force does modify the stress condition within the walls of a stoping area at any time, in my opinion the only final answer to wall closure is a complete fill squeezed to the point where voids are practically eliminated. Given such a condition, it is then possible, without limitations as to stoping span or other variables, to examine wall conditions that one can confidently expect to maintain by support.

Fig. 5 illustrates the point. Compression on the fill and fracture zones A and B has practically arrested the extension of the fracture zones into the walls. The failure or removal of the pillar transfers the zone C from the state of confining pressure into the enlarged fracture zone A B C. The failure may have been sudden as a burst, but with the flatter domes the amount of ground transferred and the energy liberated in the process are much less than they would have been with unrestricted domes.

There is no means of determining when this condition has arrived, but if it depends on resistance comparable to the stresses developing the dome, with the best fill as support, it can only take place over a very substantial stoping span, and after mining in that particular area of compression has long since passed. It is well to bear in mind that, with the best fill possible, in the mining leading up to this condition rock bursts can occur of sufficient magnitude to propagate seismic waves several hundred miles. The probability of arriving at this condition of a fully restricted dome, with unit-type supporting methods, is correspondingly more remote, as it is my opinion that no unit-type support can approximate the effectiveness of early and well placed fill in resisting wall closure.

If we can assume that support will not stop rock bursts and its ability to restrict dome development positively is limited, the subject begins to assume proper proportions. If, aside from the requirements of the mining method, support is introduced to control movement in the fracture zone, it serves its proper purpose. If in this process it intensifies the arching stresses within the fracture zone to the point where there is a steady and increasing resistance to the development of the dome, the effect on the outside stress pattern must be entirely favorable. How favorable it can be we do not know, but it represents the only means at our disposal of modifying the stress pattern, and under any but retreating methods this must be regarded as a desirable objective.

Two Conditions

If, as a result of the foregoing review, it can be accepted that the sequence in which ground is stoped is the important factor in reducing or eliminating the occurrence of rock bursts, we are left to consider two conditions:

1. The unstoped orebody.
2. The orebody stoped to the point where rock bursts are a major problem.

The Unstoped Orebody. With every orebody possessing its own distinctive association of rocks and structural characteristics, in an article of this nature, without reference to a specific orebody, it is only possible to suggest certain lines of thought based on features of a common nature.

If, as referred to under theory, the dimensions of an orebody are defined as length, breadth and width, breadth is the most important from the pressure point of view. It represents the ultimate minimum stoping span and thus controls the ultimate penetration of the fracture zones and domes in either wall. In controlling the size of domes it also determines the ultimate depth of abnormal stress surrounding them.

Some Latitude

Where the breadth is of the order of 200 to 300 ft. or less, with no serious structural complications, considerable latitude is permissible in the stoping of the orebody, regardless of the depth, though it is well to remember that pillars and sills are always an added risk under pressure conditions.

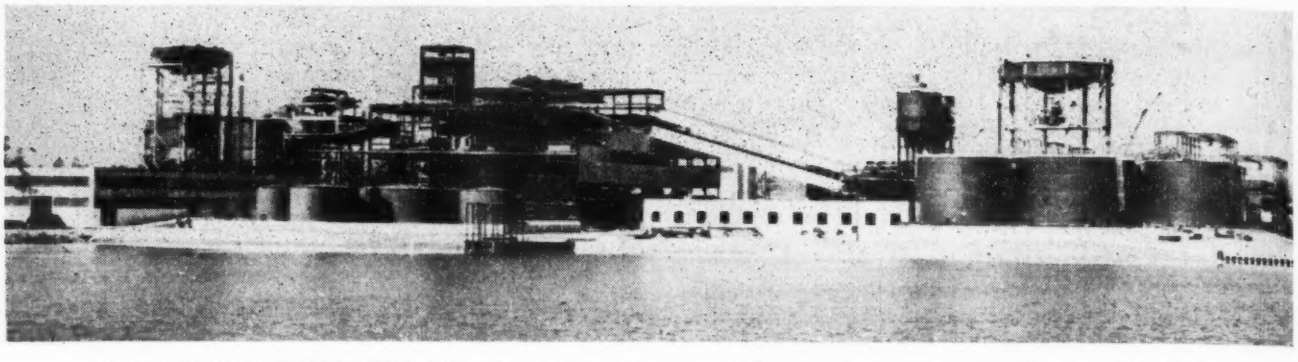
A single shaft may serve several such shoots on both the strike and dip, and the maintenance of levels through such stoping may thus be essential.

Again, excluding structural features, such orebodies are best stoped from the center outwards, stope support and steel setting of levels following a reasonably coordinated line of stope faces. Providing the stress pattern is not complicated by nearby stoping, level setting seldom needs to extend more than 50 ft. beyond the stopes into the solid.

With increasing breadth of ore, however, our troubles really start. While different factors, such as grade, width of ore, volume of production, and mine layout, enter every problem, it is my view that with orebody breadths somewhere between 500 and 1,000 ft., maintenance of level and stope support costs are likely to swing the picture in favor of retreating. With this method, the problem of level maintenance is practically eliminated and stope support is reduced to that required at the working face. If this contingency can be foreseen and the mine laid out accordingly, it is certainly sound insurance.

Retreating or advancing methods of stoping, if desired, or combinations of both, can with an orderly sequence of faces commence at the center of an orebody or any other predetermined point and work outwards, or from either extremity of the ore and work back, and also on occasion up or down the dip.

With such methods, for any



NEW NORALYN PHOSPHATE PLANT of International Minerals and Chemical Corporation in the Florida pebble field.

Florida's Newest Phosphate Plant Ready

INTERNATIONAL MINERALS & Chemical Corporation expects to put its new Noralyn phosphate mine and plant in the pebble field near Bartow, Florida, in operation in March, according to Franklin Farley, vice president of the company's phosphate division. The plant, shown above, will be the largest of its kind in the Western Hemisphere. It has been designed to produce 1,500,000 tons of phosphate annually, and will employ the most up-to-date practice. With it in commission, the company should have a total capacity in Florida of 3,500,000 tons of phosphate per year, or more than all companies operating in the State produced before the war. The deposit that will be worked is one of the richest thus far found.

Theory and the Practical Problem of Rock Bursts *(Continued)*

given volume of developed ore, output for the first 50 to 60% of the stoping is naturally lower than obtainable with a more indiscriminate stope distribution, but there is a greater assurance of 100% of the orebody being mined at a reasonable rate of production than is possible with any other method. In fact, with any other methods after 60% extraction, the management is likely to find itself waging a losing battle with ground pressure for control of the operation.

The orebody stoped to the point where rock bursts are a major problem. Such a situation usually means that the ore remaining has begun to assume the form of pillars of varying types and sizes. Here again, each orebody has its own peculiarities, and generalization can go only so far. There are, however, a few factors common to all, which it is well to bear in mind:

The stress pattern over the area has been established, and there is little that can be done to control its subsequent course. With the first appearance of an increasing rockburst frequency, it is well to assume the tendency will continue and accept the reduced output involved in introducing an orderly sequence of faces either retreating out of, or advancing into, the area, depending on the state of traveling ways and possibilities of maintaining them.

Where such areas have been openstoped, there are those who advocate filling the old stopes as a means of precluding rock bursts in the final stoping, overlooking the fact that similar conditions can arise in orebodies where fill has followed the working face and thus been subjected to the maximum compression.

While it is not considered that any advantage is to be derived from further support in areas already stoped, except where the security of traveling ways is involved, the greatest volume of the most effective type of support locally practicable is desirable with the current stoping to secure the best control over the extension of fracture zones in either wall, and such consequential benefits as may ensue in the local stress pattern.

Conclusion

A study of this and preceding articles must leave the reader with the impression that the problem of ground failure under pressure is far from being an exact science. Probabilities and possibilities appear prominently in the picture, particularly where rock bursts are concerned and the limited facts available must be supplemented by an element of shrewd guessing in any particular case. If, however, the reader is now able to cast his mind beyond individual mine excavations into the more obscure realm of fracture zones, domes, and stress zones, it will be apparent that the occurrence of rock bursts can be reduced to comparatively simple proportions as follows:

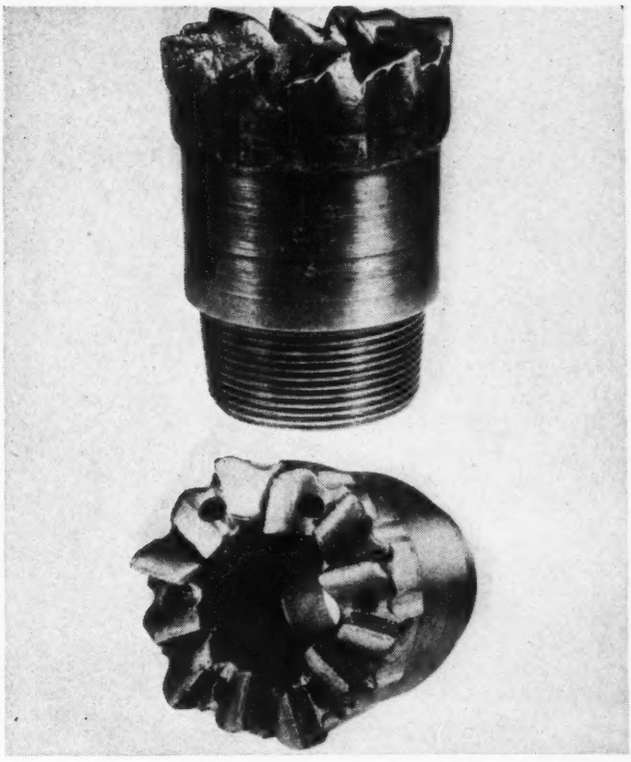
1. The single stress zone of any opening may infrequently precipitate a rock burst.

2. The stress zone of a large opening enveloping that of a small one is a more susceptible condition.

3. The stress zones of two or more large openings (stoping areas) meeting on common ground (pillars) in all probability will cause rock bursts of the heavier variety, and development points existing or being driven through such ground are particularly susceptible to violent bursting.

It therefore follows that stresses of the lowest possible order can be expected only when stoping is carried out with a coordinated progression of stope faces, precluding the formation of pillars. If the stoping can be done on a retreating basis, the requirements of level maintenance and stope support are at a minimum. If retreating is not possible, a yielding but resistant type of support in the maximum volume should follow the working face as closely as possible. Other mine openings should be disposed with due regard to the ultimate stress pattern which will develop with stoping.

NX-SIZE CORING CROWN, cutting 2⅛-in. core, drilled 30 ft. of reinforced concrete with high percentage of aggregate.



SLABS OF MATERIAL described are inserted vertically as shown. The 12 welded cutting teeth thus formed are very hard and tough.

A New Material for Drill Bits

USE OF A CERTAIN ABRASIVE or cutting material, said to be hard as tungsten, tough as steel, and unbreakable, which gave remarkable results in shop work in England during the war, has been extended to core drilling since the end of hostilities. Comparable results have been obtained in the new field, according to the makers. The material is known as Carbometal.

Success with this material in an oil-well drilling job in Yorkshire is cited. A hard formation, struck at 6,000 ft., baffled all attempts to take a core. Six hundred roller bits were used in drilling the next 950 ft., without a core being obtained. Last September, a coring bit of the material named, 7⅜ in. in outside diameter and of 3⅝-in. inside diameter, was tried and the first core was taken at 7,000 ft. Penetration speed was satisfactory and core recovery was 86%, according to the bit company. At last report, this borehole was 7,510 ft. in depth.

Another instance involved drilling with a prospector rig in the Chesterfield area, also in England. Here, extremely hard strata were encountered. With percussion drilling a shift had been required to penetrate 1 ft. of sandstone. Using a fishtail bit of Carbometal, the drilling of about 57 ft. in two holes was completed in about 7 hr., the bit showing no wear or loss of gage as a result.

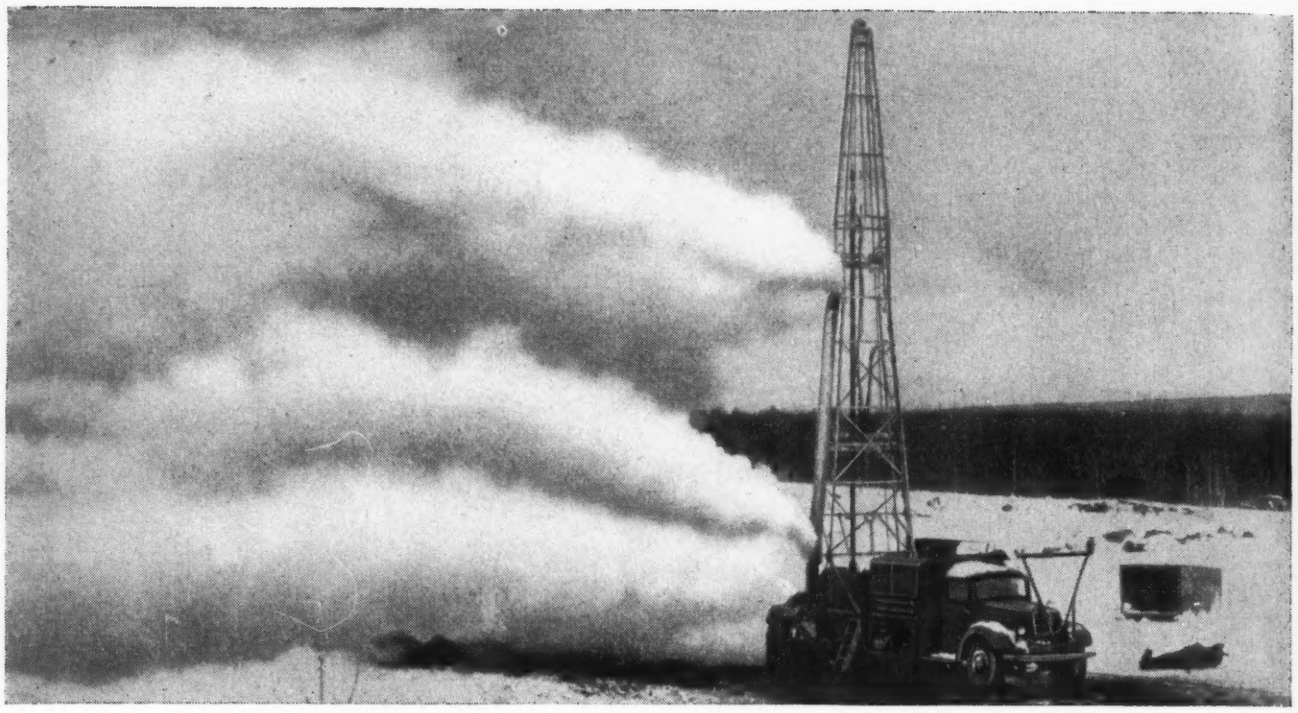
Patented Here and Abroad

The cutting material discussed is a product invented and made exclusively by the London company mentioned. It is as hard as tungsten, according to the maker, tough as steel, unbreakable and not brittle. It can be molded and welded and need not be brazed. It is further asserted that it can be produced in any quantity from materials widely available. It is covered in U. S. Patent No. 2,391,589, Abrasive Tool, issued Dec. 25, 1945 to Leon Nussbaum, London, assignor of one half to Hatim Attari, London. The claim made is: "An abrasive or cutting tool....comprising a body formed of diamond particles bonded together by a bond which functions as a secondary abrasive and consists of a mixture of boron carbide, silicon carbide, and at least one metallic carbide."

The material used as the bond is produced in (a) crystalline form. Compressed into a cutting wheel, the maker claims, it will cut tungsten carbide. Mixed with diamond fragments, it makes the drilling crown, or bit, here illustrated. (b) It is also produced in "metallic" form, for hardfacing. This is supplied as tipped drill bits for mining, prospect drilling, and rock drilling; also as hard-facing material in the form of welding rods or tips.

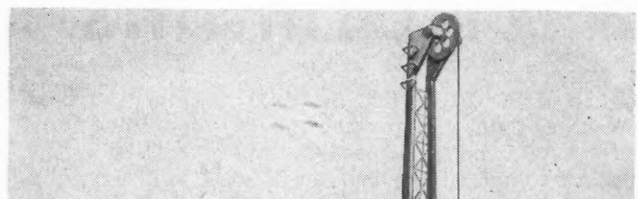
The diamond-impregnated bit made with this material is said to present, in its finished state, a very robust drilling face which will withstand considerable weight, pressure and shock. It is made so that diamonds that break away or diamond pieces will not damage the crown itself. Instead, the diamond torn from the face will leave a patch consisting of other diamond particles and, also, of a matrix containing particles of highly wear-resistant and abrasive carbide. Impact of rock cuttings on this spot serves to sharpen it. The net effect is said to make fishing jobs unnecessary.

The makers are Carbometals, Ltd., Aquila St., St. John's Wood, London, England.



1. JET-PIERCING in winter field tests on property of Erie Mining Co., Aurora, Minn., on Mesabi Range.

Jet-Piercing Up-to-Date



2. COMMERCIAL RIG for jet-piercing that is now under construction, as it has been conceived by the artist.

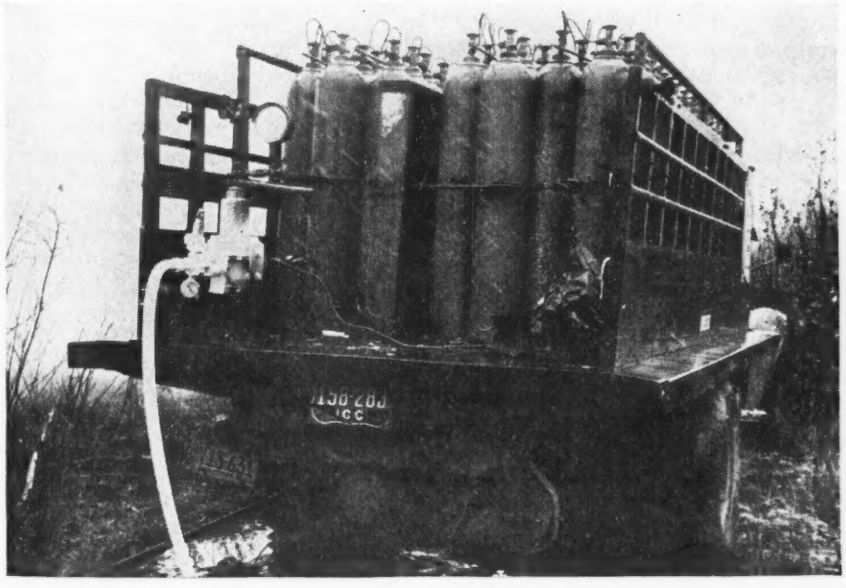
Commercial rig, as now visualized, will have minimum capacity of 100 to 150 ft. of hole per shift. Crawler mounting and powered leveling jacks will permit moving to new hole and setting up in less than 30 minutes. It is anticipated that this equipment will be available for piercing primary blast holes by the latter part of the coming summer.

J. H. ZIMMERMAN
Manager, Development Division
The Linde Air Products Company

TABLE I. Oxygen and Fuel Consumption

Material Pierced	Total Footage	Speed Ft./Hr.	Average Consumption Oxygen, Cfh.	Fuel, Lb./Hr.	Water Gph.
Magnetite	174	8.5	2,600	100	300
Hematite	97	14.0	2,570	109	300
Dolomitic Limestone ..	103	31.5	2,500	72	300
Coarse Granite ..	5	20.8	2,800	65	300
Quartzite	158	28.4	2,260	80	300

3. EXPERIMENTAL PORTABLE RIG piercing inclined holes, Drummond Island, Mich.



4. MANIFOLD CYLINDERS, brought to site of the hole-piercing operations on truck, proved satisfactory as a means of supplying oxygen for the field tests at Babbitt.

THE FIRST EXPERIMENTS with jet piercing (as fusion piercing has been renamed) were conducted over ten years ago underground at the Soudan mine of the Oliver Iron Mining Co. in Minnesota. Results were successful enough to encourage further research. The next field tests were made on the Reserve Mining Co. property at Babbitt, Minn., in 1941. These showed that blast holes could be produced in taconite by use of a flame and proper fluxing agents. The war stopped the experimental program shortly after these tests.

Tests were resumed at Babbitt in 1946. The results were reported in *Engineering and Mining Journal* for November, 1946, as well as in other publications.

During the summer of 1947 tests were again conducted at Babbitt. The rig used the previous summer had been modified in accordance with the findings of the tests then made. In the 1946 experiments a fluxing ingredient had been combined with the fuel, but a blowpipe of radically new design made it possible to omit the flux in the 1947 tests. Thus the step of mixing the flux-fuel was eliminated.

The ore at Babbitt is a low-grade striated iron deposit. The dense, banded rock contains about 30% of magnetically recoverable iron. Nearly 40 holes were pierced in five locations, covering all the representative formations to be encountered on that property. They were put down in solid ledge in cracked and fissured rock, near faces which had been blasted, under more than 25 ft. of water, and through overburden consisting of clay and glacial drift 1 to 3 ft. thick.

Holes pierced averaged 9 in. in diameter and 31 ft. deep. Of the 1,180 ft. of hole over 400 linear ft. was pierced solely by Reserve Mining Co. employees who handled all controls.

Data covering the overall performance at Babbitt are given in Table II. Average operating conditions are listed in Table III.

Before stopping work for the winter, the rig was moved to the Erie Mining Co.'s property at Aurora, Minn., also on the Mesabi Range, to work on a proposed sink cut area. Under winter conditions, as shown in Photo I, 15 holes, 9 in. in diameter and about 31 ft. deep, were pierced at an average speed of

Abstracted from a paper presented before the Mining Symposium of the University of Minnesota School of Mines at Duluth, Minn., Jan. 14, 1948.

TABLE II. Overall Performance Data at Babbitt, Minn.

Number of Holes	38
Total Footage	1,180
Total Hours Burning Time	62.8
Piercing Speed, Ft./Hr.	18.9

TABLE III. Average Operating Conditions at the Tests at Babbitt

OXYGEN	
Pressure, psi.	225
Consumption, cfh.	9,460
FUEL	
Pressure, psi.	150-175
Consumption, lb./hr.	281
WATER	
Pressure, psi.	60-70
Consumption, gph.	656

21 f.p.h. One was pierced at an average of 30 f.p.h. More than a third were pierced with mining company employees at the controls.

All work described so far was done with a truck-mounted rig capable of producing only vertical blast holes. During the summer, a smaller rig, capable of producing holes at any angle from horizontal to vertical, was tested at many locations. This was definitely experimental. It consisted of a blowpipe mounted on a standard wagon drill. Power unit and auxiliaries were carried on a light truck. The 14-ft. blowpipe produced a 3½-in. diameter hole.

Formations on which this rig was tested included high-grade quartzite, dolomite, low-grade iron ore, and common granite. Holes inclined at 30 deg. to the horizontal were made in dolomite at an average of 35 ft. per hour. These operations are shown in Photo 3. Many mining officials, explosives engineers, and other interested parties witnessed the tests. In its performance, the rig suffered from mechanical deficiencies plus the fact that it lacked adequate speed and depth controls. It was intended to incorporate the latter devices.

Instruments Delayed

Deliveries were so slow, however, that a full season in the field would have been lost if the work had been held up until the instruments were received in September. The data for demonstrations in Minnesota, Northern Michigan, and central Wisconsin are given in Table I.

Companies cooperating were: Baraboo Quartzite Co., Baraboo, Wis.; Cleveland-Cliffs Iron Co., Ishpeming and Republic, Mich.; Drummond Dolomite, Inc., Drummond Is., Mich.; Erie Mining Co., Aurora, Minn.; M. A. Hanna Co., Keewatin, Minn.; Harbison-Walker Co., North Freedom, Wis.; Jackson County Iron Co., Black River Falls, Wis.; Jones & Laughlin Steel Corp., Star Lake, N. Y.; and Pickands, Mather & Co., Hurley, Wis.

Much was learned, mechanically and in respect to process, as a result of this varied work. Design and construction are being pressed with all speed.

As a result of the 1947 field tests, it has been possible to formulate the requirements of commercial equipment for producing vertical blast holes. The rig as now visualized (Photo 2) will have full crawler mounting permitting most hole-to-hole moves to be made with mast erect. Powered levelling jacks will reduce set-up time after a move. Such a rig will permit hole-to-hole moves and set-up in well under 30 minutes. Based on an average speed of 20 to 25 f.p.h., a minimum of 100 to 150 ft. of hole per shift could be expected.

The Bucyrus-Erie Co., South Milwaukee, Wis., is cooperating actively with the Linde company in the development of the first commercial equipment. It is expected that it will be ready for piercing primary blast holes by late summer this year.

Blasting Pierced Holes

Hole-volume measurements indicate that, from the viewpoint of explosive capacity, the jet-pierced holes should be comparable to 9-in. churn-drilled holes after a suitable loading technique has been evolved. Volume measurements were made by filling the holes with accurately-measured quantities of finely-crushed rock. The rock level was measured after each addition and a plot of level against rock quantity then gave a measure of hole diameter at various levels.

Temperature of the water standing in the bottom of several holes immediately after piercing was recorded at 150 deg. to 175 deg. However, it must be remembered that the rock surfaces and subsurface fissures or openings were heated to extremely high temperatures. Water-flooding or an adequate time lag must precede the loading of jet-pierced holes with explosives.

In conjunction with the piercing program, other tests were made to determine if the standard blowpipe could produce chambering at any desired level. This was found readily possible. Chambers 15 to 20 in. in diameter by 5 to 24 in. in height were produced by holding the blowpipe at a fixed level for several minutes. Through the development of specially-designed nozzles it is expected that the production of chambers of variable size and shape will become an important and definite part of piercing operations.

Oxygen for Jet Piercing

The problem of providing oxygen for jet-piercing requires an answer to these fundamental questions: (1) What quantities are going to be needed? (2) How will the demand vary? (3) What pressure must be maintained at the blowpipe?

The answers are perhaps 50% known at present when thinking in terms of the general application of piercing. For instance, for a given type of material and a given size of hole the oxygen consumption per rig per operating hour can only be approximated on the basis of the present state of the art. In fact, in 1947 the requirements per foot of hole were well below the figures established in the 1946 tests. Furthermore, for a given operation, the total oxygen requirements at the site will depend upon the tonnage mined, the rate of mining, and the depth of holes wanted. As the use of piercing at any one operation increases, the oxygen requirements will also increase and it is very difficult at this time to establish what the maximum oxygen requirements may be. However, the requirements will not be excessive, as compared with other well established large uses of oxygen.

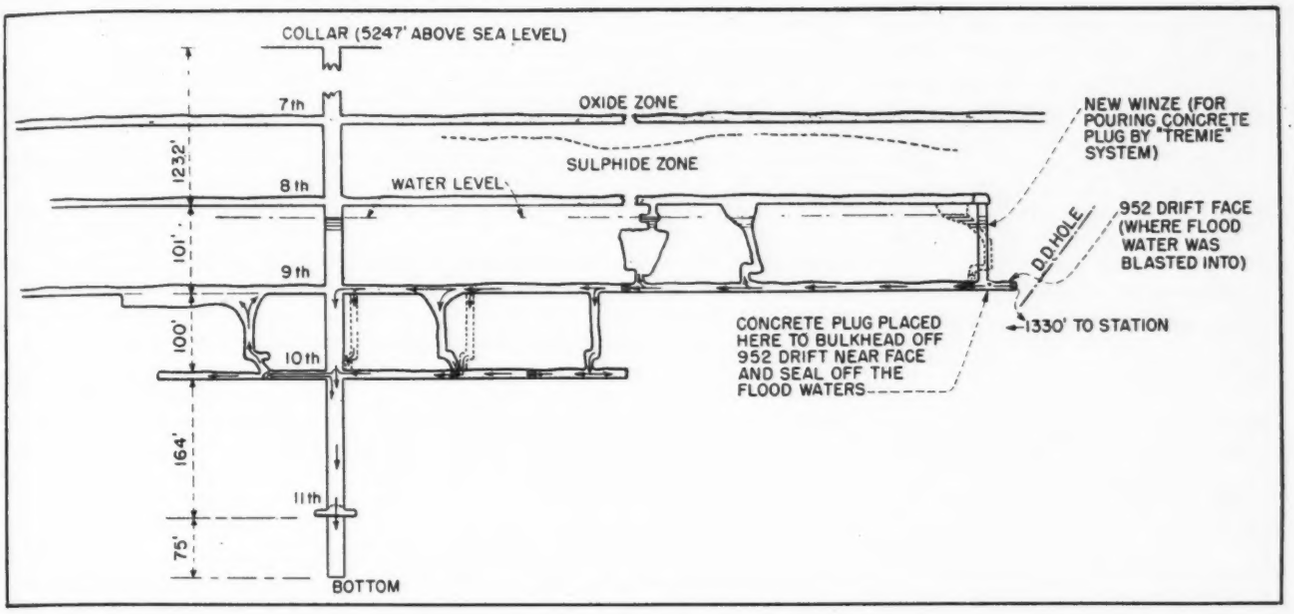
The variation in oxygen demand is known to some extent. Mining operations are generally carried out for ten to eleven months of the year in the Northern Minnesota and Michigan areas and, generally, piercing would be done on not more than two shifts. Thus, both the hourly and the monthly consumption will vary between a maximum and no consumption at all. Such wide variation in the demand rate, which has already been successfully met in the oxy-acetylene industry, must be given serious consideration to assure a steady supply of oxygen at constant pressure.

Higher Pressure Possible

The field tests reported in the first part of this paper used oxygen supplied to the rig at a pressure of 225 psi. What the pressure may be in the future is pure conjecture. At present, there is some indication that higher pressures may result in more economical operation. Oxygen for the field tests was supplied by manifolded cylinders, as shown in Photo 4.

About 15 years ago, the Linde company developed the so-called Driox liquid-oxygen distribution system for supplying the large volume demands that were developing. This system in its present highly-developed and diversified form lends itself very well to piercing operations.

To sum up, jet-piercing has come of age and all necessary materials and facilities that are required for its successful application are immediately available.

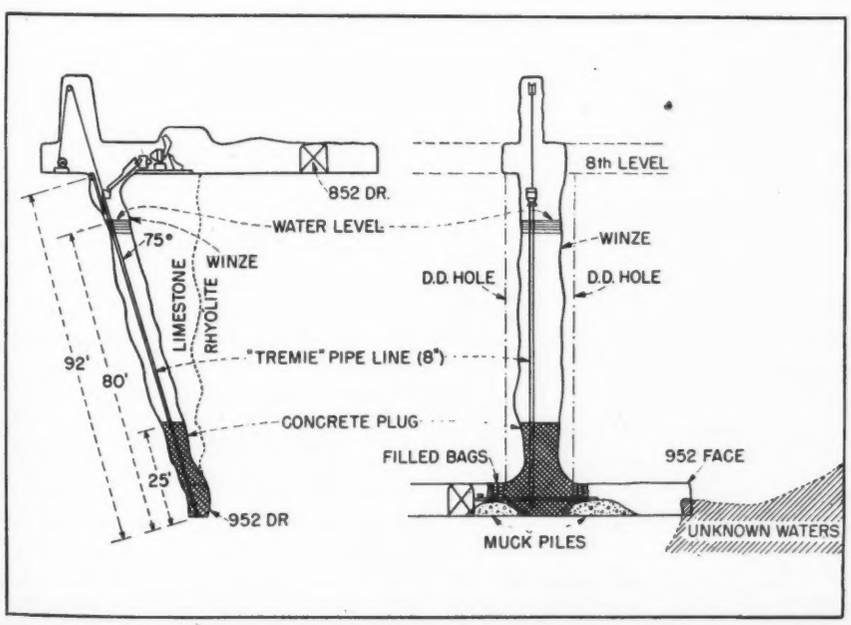


SAN ANTONIO MINE, in longitudinal section, showing point where flood waters broke in and subsequent water level in mine.

Sealing Off Flood Water in the San Antonio Mine

Divers were employed 1,000 ft. underground to place a concrete bulkhead under 83 ft. of water

C. M. SYNER
Apt. 3 Bis, Chihuahua, Chih., Mexico



CONCRETE PLUG placed at junction of winze with 952 drift to bulkhead the latter off near the face and seal off flood waters, in two views.

DEEP-SEA DIVERS probably have been used for small special jobs of one kind or another in shafts that were under water. The work here described of sealing off the flood water in the San Antonio mine is the first case, I believe, in which a major construction job has been attempted more than 1,000 ft. underground and under 83 ft. of water.

The San Antonio is about 20 miles east of Chihuahua City, Mexico. It is an old mine in a limestone area with rather extensive workings down to the tenth level, which is approximately 1,440 ft. below the shaft collar. The orebodies are irregular chimneys and mantos found in an area between a zone of north-south-striking rhyolite dikes and a north-south fault zone, known as the West Fault. Above the seventh level, deposits are all oxidized; the sulphide zone is below. In the upper levels there are occasional dry, open limestone caves ranging up to 600 ft. long and 25 ft. by 100 ft. in cross section.

The mine has had a rather unique record as to ore production. Until 20 years ago, it produced a direct-smelting lead-silver ore; then it was found that some of the oxidized ores contained commercial quanti-

ties of tin and a mill was built and operated for several years for the concentration of this tin; then at certain horizons in the mine a lead-vanadate ore was discovered; this also was treated in the mill. After the exhaustion of these ores, lead-zinc sulphide ores were developed and more recently, in a mine that has always been practically dry, a full-scale flood occurred. After all of this, nothing will surprise us.

On the night of Nov. 10, 1945, a blast in a heading on the ninth level in the southern end of the mine broke into a body of water, which discharged itself into the workings at approximately 100,000 gpm., completely filling the mine to within 6 ft. 4 in. of the eighth level in only 2½ hours and causing the loss of six lives. It is estimated that a total of 16 million gallons entered. After 16 months of difficulties, at the time this paper is being prepared, we have sealed off these waters by building a concrete bulkhead under 83 ft. of water.

A Huge Volume of Water

At the time the water broke in, we assumed that only a relatively large water-filled cave had been tapped, and that, with reasonable pumping capacity, the mine workings and the water remaining in the cave could be drained in a few weeks. In a few days, pumps to a capacity of 1,300 gpm. were obtained and installed on the eighth level. This capacity was the limit for our transformers. Three air lifts, 6-in., 5-in. and 4-in., were installed to raise the water to the sump that fed the pumps. For nearly three months, pumping, at 1,300 gpm., was in progress. During this period 140 million gal. of water was removed but the water level was lowered only 22 in. Obviously, we were faced with a volume of water enormously greater than originally estimated. Only by sealing off the water at a point near its entry to the workings could we recover the main portion of the mine to permit the resumption of mining. The drainage of the water source would be left for a later date when sufficient power and equipment could be obtained.

After study, it was decided to build a bulkhead in the ninth level drift as near as possible to the punctured face, the concrete to be poured by the Tremie system, which involves depositing the concrete under water by gravity through a vertical, or nearly vertical, pipeline. Because existing raises between the eighth and ninth levels were too far from the face or were not straight and free from obstructions, we decided to sink a winze to a point 40 ft. back from the face of the ninth level drift. Due to ground conditions this had to be sunk at 75 deg. from a crosscut on the eighth level instead of vertically downward between the eighth and ninth level drifts. This winze presented no problem save as to the safe drilling and successful blasting of the 7-ft. rib of rock left between the bottom of the winze and the back of the drift.

Two Attempts

To blast this required two attempts. On the first, a standard 22-hole round was drilled. Ordinarily, the cut holes would have been blasted first and then the rest of the round loaded and blasted. One of the holes, however, had developed considerable water and it was thought that blasting of the cut first would produce an uncontrollable amount of water and prevent re-entering the heading to blast the remainder. The entire round was therefore loaded with 110 sticks of 60% gelatin and blasted. Only the cut holes pulled, however, the others blowing out.

After this failure, a special 59-hole round was designed and drilled through 2-in. pipe nipples cemented into a concrete pad which was poured over the irregular winze bottom. This arrangement was to insure drilling according to plan and to facilitate control of water in case any of the holes met water-bearing fractures. Due to the first blast, it was probable that the block of rock was somewhat shattered. A valve was placed on the particular nipple being drilled, to close the hole if water were encountered. In drilling the round, one hole was lost because of stuck steel. Five others were left short of their proposed depth because some water was met, but instead of closing the valves we were able to seal them with short wooden plugs driven down to the bottom of the holes.

Advice on Blasting

Representatives of the powder company were consulted before firing this second round. Their suggestions were:

1. With the close spacing of the 58 holes drilled and the presence of water there would be a 70% possibility of propagation.
2. In consequence, 40 to 50 additional holes should be drilled, distributed as evenly as possible between those already drilled. These extra holes were not to be loaded, but were intended to weaken the ground between the blast holes so that, in case of propagation and failure of the cut holes to break out first, all holes would break rock instead of blowing out. In other words, the plan was to approach the condition of a large-scale "burn-out" round.
3. Use of 40% gelatin in an amount equivalent to at least 10 lb. per cubic yard of ground and a coarse sand stemming that would not disintegrate nor wash away in the water.
4. Powder should not be allowed to extend above the joint between the concrete pad and the rock.
5. Instantaneous caps should not be used. Enough delays should be used so that adjacent holes would not have the same delay.
6. As little water as possible should be left in the bottom of the winze at time of blast.

After a study of these recommendations we had the following objections:

1. Due to the nature of the rock and the difficulties in drilling the main 58 holes, it would be difficult and dangerous to drill the extra holes.
2. If we were successful in completing the extra holes, they would, on blasting, be filled with water, thereby increasing the chances of propagation and also, due to the incompressibility of water, there might not be the expected lines of weakness between the holes. To offset this, the extra holes could have been kept free from water to some extent by using tin tubes, sealed at both ends; or they could have been loaded with powder and advantage taken of full propagation of double the required amount of power.

The Round Is Blasted

We decided to abandon the drilling of the extra holes and to blast the original 58 holes, following closely the powder company's recommendations for loading. The holes were loaded with 276 sticks of 40% gelatin and blasted Aug. 7, 1946. Only one report was heard, indicating there was propagation. However, the sound was dull and extended, with no appreciable air blast at the blasting switch (720 ft. away), in place of the quick, violent explosion with heavy air blast experienced on the first attempt on May 29. This indicated a consider-

able breakage of rock rather than a blowing-out of holes. Due to smoke in the winze crosscut, it took 20 minutes to reach the collar. This done, it was found that the winze had filled with water to the elevation of the water level in the mine; that the stulls, planks and ladders left in it had been stripped out clean and had dropped down into the winze below water level; and that most of the nipples from the concrete pad and some muck were piled up on the crosscut floor on the footwall side of the winze collar.

It was certain the blast had broken through to some extent. It was not possible to determine the size of the opening. The tangled mass of timber made probing difficult. We put down a string of ½-in. pipes to a point 86 ft. below the collar, approximately 2 ft. below the back of the ninth level drift. Attempts with stiffer 1-in. piping were not successful.

We removed considerable timber by blasting small charges of powder at the horizons where it was met, but were still unable to thrust a pipe down to probe the connection, because the bottom seemed choked with broken rock.

Divers Are Employed

We could do no more. Divers from San Francisco had been engaged for placing the concrete bulkhead. They were now advised we were ready for their services. They arrived Aug. 23.

Upon inspecting the winze, the divers found that our attempts to blast out the entangled timber obstructions had resulted in loosening considerable rock from the walls. This had accumulated on the footwall for approximately 40 ft. Obviously, we had erred in leaving the timber in. However, there were spots of loose ground along the walls and it had been thought the timber would help support these areas and protect the divers. Also, there had been some heavy planking on the footwall to serve as a slide for the bucket during sinking. This had been left to aid in raising and lowering the pipeline to be used for pouring the concrete. We had stripped out the lower 30 ft. of the timbering, thinking the effects of the blast would not reach above this point.

To remove this material, a hoisting bucket was rigged up for the divers. After approximately ten days of underwater mucking they were able to reach a point 65 ft. below the collar. Here it appeared that the winze over its entire cross-section was filled with broken rock. As much of this was fine material, a 6-in. pipe line was installed for its removal. A special nozzle was made so that the fine rock could be jetted into the bottom intake with high-pressure water. This nozzle was specially designed by the diver in charge. It was made with two opposing orifices so that the reaction of the two streams would counterbalance each other. Working with this air lift and water jet for removing the fine material, and with the hoisting bucket for material too large for the air-lift, we were able, by Oct. 6, to clear the winze down to a point approximately 2 ft. below the back of the 952 drift.

Breakthrough Full Size

We now learned that the final blast had connected through to the top of the ninth level drift the full size of the winze. It was found that it had caused a considerable overbreakage along the hanging wall and at the end walls of the winze. This would require the removal of a much greater quantity of broken rock and the construction of a much larger bulkhead than had originally been anticipated.

Up to this time, most of our difficulties had been technical problems. That night, however, one of the divers and his helper, while returning to camp in their car, missed one of the many curves on the road to Santa Eulalia and rolled several hundred feet down a steep hillside. After two weeks in the hospital they were able to return to their homes in San Francisco. In the meantime, the diver in charge encountered various labor and legal difficulties, as a result of which our work was entirely suspended until the first day of 1947.

In the next few weeks, the divers removed most of the muck pile from the ninth-level drift, clearing a space approximately 10 ft. long on the floor. Also, they were able to crawl over the pile left on the south side of this space and inspect the punctured face to determine the nature of the hole through which the water had entered. They reported a hole 2 ft. wide by 4 ft. high in the right side of the drift, 2 to 3 ft. back from the face, but were unable to determine the nature of the cavity back of the hole. The side drill holes of the previous round had missed this cavity by only a few inches.

Several days were now spent in placing bags, some filled with straight sand and some with a mixture of sand and cement, on either side of the cleared space on the level beneath the winze connection. The object was to form walls between the drift floor and the back of the connection so as to retain the concrete which was to be poured into this area.

By Feb. 6 all preparations had been completed for pouring concrete. The first attempt was made the following day. It failed, because the Tremie pipe choked up after one hour of pouring. The main reasons for this, apparently, were the use of coarse aggregate (—2 in.), too large a ratio of aggregate to sand (the mixture was 1-2-4), and too dilute a mixture. The last factor allowed segregation of the cement and aggregate when poured down the pipe.

We then decided to try again with the following changes in procedure:

A minus 1-in. aggregate and a 1-3-2½ mixture were substituted. To increase the fluidity of the concrete without using too much water, "Pozzolith" was employed. This compound also causes the sand and cement to cling to the surfaces of the aggregate and prevents what is technically called "bleeding." A pressure head for the Tremie pipe was provided to permit applying air pressure in case the pipe started to choke. A large hopper was provided also at the top of the Tremie pipe, so that when the concrete was made to move down the pipe, a larger volume could flow without lowering the level more than a few feet down into the pipe. This would prevent the new batches of concrete from falling very far through an empty pipe and causing segregation and packing.

Pouring the Concrete

The second attempt, which proved successful, was made Feb. 19. The following details will give the picture:

The 8-in. conveyor pipeline consisted, from bottom to top, of three full lengths of pipe coupled together, one short length of pipe, and six 2-ft. nipples, flanged together. The bottom of the pipeline was sealed by a tightly-fitting disc which could be loosened to let it slip off when desired. This was to keep the pipeline empty until filled with concrete before starting the pour. At the top end of the pipeline a steel hopper was fastened (by a flange), widening out to 30 in.

square at the top and having a capacity of about half a cubic yard, so that the surface of the concrete could always be kept in sight when it dropped at the periodic raising and lowering of the line to let the concrete flow out below. A special frame was built around the hopper, to which was fastened the cable from an electric hoist for raising and lowering the line. A gear-block was installed to provide for suspending the pipeline from a point lower down, while nipples had to be disconnected and removed as the line moved upwards, due to the rising of the concrete deposit below.

Two 5-cu.ft. motor-driven concrete mixers were set up in tandem in the crosscut close enough to the winze for the concrete to run by gravity down a swinging launder into the hopper of the pipeline, which was below the collar. The first mixer was of the type which has a scoop that is filled from wheelbarrows with the required amount of materials to form one batch and which is elevated by a hoisting mechanism to discharge its load into the barrel. The second was of the type having a stationary chute slide for loading the barrel and a movable chute slide for discharging the load. The two mixers were set up so that when the barrel of the first was tipped for discharging, the load ran directly into the entrance chute of the second mixer, and when the movable chute of the second mixer was lowered it discharged into the launder to the pipeline hopper. The materials were mixed dry in the first machine and wet in the second. A water-measuring tank was fastened over the latter.

Storing Materials

The development work done on the 800 level to furnish room for storing materials and for movement of workmen consisted of two crosscuts leading from the main eighth level drift to the winze and converging to form a single crosscut near the winze. The machines were placed in the converged single crosscut, close to the collar. The cement was stacked along the side of one crosscut near the scoop of the first mixer. The sand and crushed rock were stored in the drift at or near the throats of the two entries so that the men handling the wheelbarrows of rock could use one crosscut as a roadway and those handling sand could use the other and thus avoid interference. The Pozzolith used amounted to comparatively a few sacks and took up no appreciable room. Pneumatic-tired wheelbarrows were used to make the handling of materials as easy as possible.

Success depended largely on the rapidity of pouring, so a full morning was spent in making final adjustments to the mixing equipment and conveying pipeline installation, and in making several trial batches to insure proper working efficiency of equipment and crew. The actual pour was started at 1 p.m. and completed at 9 p.m., the total elapsed time being 8 hr. Time of mixing for each batch varied from 1 to 1½ min. Taking the average time per batch as 1¼ min., the actual time spent in pouring the 305 batches used was 6 hr. and 20 min.

A Difficulty

At one time only was there serious difficulty. This was soon after the pour had started. Due to difficulty with the operation of the valves on the water-feed tank, an excessive amount of water came through with two batches of mix. This resulted in segregation of materials in the pipeline to the extent that the concrete stiffened and could not be made to move with the raising and dropping of the line. The hopper was disconnected, a pressure-head (on hand for such an emergency) was fastened over the top of the line, and the concrete mix was successfully started through the pipeline by applying 90-lb. air at the top of the column.

The rest of the time lost was taken up by those occasions when nipples had to be removed as the pipeline moved upwards with the rise of the concrete deposit as it built up below. During these periods, the work was so done that concrete could be poured into the line and moved at intervals of not more than 10 min.

The mixture used was 1:3:2½ (as already stated), material per batch being as follows: 1 sack American cement; 3 cu.ft. sand (—¼ in.); 2½ cu.ft. crushed limerock (—1+¼ in.); 1.65 lb. Pozzolith; and 8½ gal. water. The total amount of concrete poured was 305 batches.

The measurement to the top of the deposit from the collar of the winze was 67 ft. 5 in., or the top of the poured plug was 24 ft. 9 in. above the ninth level rail. Our objection was to get the top of the pour at least 20 ft. above the rail. We exceeded this by about 5 ft.

Pouring procedure was as follows: The pipeline was filled with a mixture of sand and cement (no gravel); the diver then went down and loosened the flange at the bottom of the line so that it would slip off when the pipe was raised; then the pipeline was raised a few inches to allow the flange to come off and about two batches of concrete were run out and then dropped onto the deposit again. Thereafter, the regular mix was poured, the pipeline being raised and dropped each time it filled up to the top of the hopper, allowing about two batches to run out.

Save for time lost early in the pour, when the concrete tended to stick in the pipe due to segregation, the operation went along smoothly. There were occasions when the concrete moved down as poured into the hopper, without raising and dropping the pipe, showing that at those particular times the bottom of the pipe was at just the proper distance below the surface of the deposit for the difference in pressure between the concrete column in the pipe and the water pressure outside the pipe to equal the frictional and submergence resistance to the flow of concrete through the pipe. A 2-in. airlift was installed working from the water level in the winze to a discharge point in the eighth level drift. It operated continuously to remove the water that rose in the winze due to the displacement by the concrete being deposited below. After the concrete began to fill the throat of the winze, the water rose faster than the capacity of the airlift, with the result that at the finish of the pour the level in the winze was 4 ft. higher than normal.

A Well-Bonded Plug

The diver in charge of the operation checked the filling of the area frequently during the pour and assured us that, with the satisfactory speed of pouring and the nature of the mixture, there was every reason to expect that we had a plug of good solid concrete, well bonded to the floor, walls, and back, that would effectively seal off the flood waters.

As this paper is being prepared, the water level is 13 ft. 7 in. below the eighth level, a drop of 7 ft. 2 in. since the concrete was poured, this with a pumping rate of only 100 gpm. for domestic service. We are certain the bulkhead has effected a tight seal, and within a few days we will proceed to unwater the mine by full-scale pumping.

MARKETS — Trends and Prices

Sharp Downward Adjustment in Grain Prices Fails to Shake Buyers' Confidence in Metals

THOUGH GRAINS and other agricultural products broke sharply during February, shaking confidence in the stability of the entire price structure, the market for major non-ferrous metals continued on a firm basis. The stability of copper, lead, and zinc was generally attributed to the fact that the price level for these metals at no time even approached the dizzy heights attained by wheat, corn, and cotton. The possibility that the break in agricultural products will be followed by easier prices in other sections of our economy later in the year caused buyers of semi-finished and finished products to take a more cautious view of all markets. So far, however, there has been no let-up in the demand for the basic non-ferrous metals.

With Prime Western zinc at 12c. per pound, East St. Louis, throughout February, the E. & M. J. index of non-ferrous metal prices for the month advanced to 155.63, against 154.20 in January. In precious metals, refined platinum advanced $3 an ounce troy on continued demand from "outside" speculative buyers. Silver of foreign origin was unchanged. Quicksilver was slightly lower on evidence that supplies were ample.

Wide publicity in the press, largely derogatory, followed on the heels of an announcement by Carnegie - Illinois Steel that it has raised its prices on semi-finished steel about $5 per net ton. Benjamin F. Fairless, president of the United States Steel Corporation, defended the action of its subsidiary by declaring: "There has been no general increase by Carnegie-Illinois in the prices of its finished steel products. Its price changes... relate primarily to an adjustment made to take care of a particular situation of limited scope. It has nothing to do with future wage demands, and should not be understood as indicating any trend in general steel prices."

Copper Deliveries Large

Copper statistics for January were better than most authorities expected. Domestic deliveries totaled 118,855 tons in January, compared with 113,446 tons in December. Combined deliveries of copper to consumers by members of Copper Institute (domestic and foreign) came to 198,817 tons in January, against 192,162 tons in the preceding month. Production of refined copper by the group amounted to 182,221 tons in January, against 196,134 tons in December. World stocks in the hands of producers, excluding Russia, Germany, and Japan, declined from 220,014 tons at the end of December to 204,378 tons at the end of January.

Whether actual consumption of copper in the United States increased in January could not be definitely established. A threatened car shortage, it is known, caused some refineries to ship metal to consumers that under ordinary circumstances would not have left their plants before February. Fabricators also moved metal out of their plants as speedily as possible to avoid shipping complications.

The December and January statistics of Copper Institute are summarized as follows, in tons:

United States

Production	Dec. 1947	Jan. 1948
Crude, primary	(a) 73,626	73,629
Crude, secondary	(a) 7,328	8,887
Totals	(a) 80,954	82,516
Refined	108,816	102,314
Deliveries, refined	113,446	118,855
Stocks, refined	76,035	71,533

Outside United States

Production	Dec.	Jan.
Crude, primary	103,583	101,725
Crude, secondary	1,522	536
Totals	105,105	102,261
Refined	87,318	79,907
Deliveries, refined	78,716	79,962
Stocks, refined	143,979	132,845

(a) Revised figures.

Increased competition for business in the wire division of the industry resulted in an announcement by Anaconda Wire & Cable that it has reduced its base prices on bare and weatherproof wire one-eighth to one-quarter cent per pound. In some quarters this was regarded as pointing to an easier supply situation in these formerly relatively scarce items. Brass prices were adjusted upward to absorb the recent advance in zinc.

The price situation in copper was virtually unchanged. Domestic consumers asked for substantial tonnages of the metal for March delivery on the basis of 21½c., Valley. In the export field, business improved, indicating that foreign buyers were badly in need of the metal. In numerous instances the foreign buyer was willing to pay a premium to obtain metal. Sales made abroad during the month were closed at prices ranging from 21½c. to 21⅞c., f.a.s. New York equivalent. Exchange problems, dealer fees, and other factors entered into the price problem in foreign transactions.

Lead Supply Tight

In spite of the heavy movement of primary lead into consumption in this country, estimated at 65,000 tons a month, buyers continue to act as if a famine exists in the metal. Producers report that they could have sold far more lead than actually available from foreign and domestic sources. Deliveries by domestic refiners are holding at around 52,000 tons a month. In December, imports of refined lead totaled 20,932 tons, against a monthly average for 1947 of 13,292 tons.

St. Joseph Lead Co. has notified its customers that it will sell its premium brands (St. Joe and Doe Run), effective with March shipment metal, on the basis of the St. Louis price plus the current freight rate but guaranteed not to exceed the New York price for common lead by more than $4 per ton. This is equivalent to 15.20c. per pound. In the C.F.A. area, which includes

U. S. Copper Imports

Imports of copper into the United States in December and Jan.-Dec. period, in tons, according to the Bureau of the Census:

	Dec.	Year 1947
Ore, matte, etc., content:		
Canada	1,908	20,624
Newfoundland	....	3,922
Mexico	1,187	11,369
Cuba	950	14,898
Bolivia	....	6,752
Chile	713	19,980
Peru	....	8,620
Yugoslavia	....	172
Philippines	....	2,130
Union of S. Africa	400	1,743
Australia	18	323
Other countries	82	548
Totals	5,258	91,081
Blister copper, content:		
Mexico	5,820	64,411
Chile	6,615	59,886
Peru	1,452	23,977
Czechoslovakia	....	1,097
Yugoslavia	2,896	10,144
Turkey	218	1,932
Union of S. Africa	715	7,903
Other countries	....	28
Totals	17,716	169,378
Refined:		
Canada	450	1,180
Mexico	....	66
Chile	23,200	143,006
Japan	....	3,226
Totals	23,650	147,478
Old and scrap, content	392	5,951
Brass scrap and old (copper content)	4,709	79,369

MARKETS—Trends and Prices

Akron, Buffalo, and Cleveland, the new selling basis works out at 15.15c. per pound. Recent freight rate increases caused the lead producer to take this action.

Demand for zinc continued active. So far as Prime Western and Special High Grade were concerned, consumers were willing to place orders for some months ahead, indicating that the recent advance in the price had no influence on the market. The two industries chiefly interested in these grades—galvanizing and die casting—have experienced no sales resistance in their products. There was some evidence late in the month that European producers were exploring the possibility of shipping zinc into this market. However, as February ended, the tone of the domestic market was firm, with Prime Western at 12c. per pound, East St. Louis. On export business, sellers were asking from 12c. to 12¼c., f.a.s. Gulf ports.

Supply and demand for silver was in balance and the quotation in the New York market continued at 74⅝c. an ounce troy throughout the month. The demand has held up remarkably well in nearly all consuming lines.

Quicksilver was spotty, with most consumers operating with great reserve in what appears to be a market amply supplied with metal. Business was placed on spot at $76 per flask, a new low for the movement. The Bureau of Mines estimated production of quicksilver in the United States in the last quarter of 1947 at 5,550 flasks, making the total for the year 23,200 flasks, against 25,348 flasks in 1946. General imports during 1947 totaled 10,228 flasks, against 23,062 flasks in 1946. Exports in 1947 amounted to 884 flasks, against 907 flasks in the preceding year. Domestic consumption was estimated at 35,100 flasks in 1947, which compares with 31,200 flasks in 1946.

Extension of the controls on tin and antimony was assured. Congress was asked to extend the regulations until June, 1949, but agreed to a temporary time limit pending further study of the entire supply-demand situation in the metals.

Major Metals

U. S. DAILY AND AVERAGE PRICES

Feb. 1948	Electrolytic Copper: Domestic (a) Refinery	Electrolytic Copper: Export (b) Refinery	Straits Tin: New York	Lead: New York	Lead: St. Louis	Zinc: East St. Louis
2	21.200	21.425	94.000	15.000	14.800	12.000
3	21.200	21.450	94.000	15.000	14.800	12.000
4	21.200	21.525	94.000	15.000	14.800	12.000
5	21.200	21.500	94.000	15.000	14.800	12.000
6	21.200	21.550	94.000	15.000	14.800	12.000
7	No Market	21.525	94.000	15.000	14.800	12.000
9	21.200	21.450	94.000	15.000	14.800	12.000
10	21.200	21.425	94.000	15.000	14.800	12.000
11	21.200	21.425	94.000	15.000	14.800	12.000
12	Holiday	21.500	Holiday	Holiday	Holiday	Holiday
13	21.200	21.475	94.000	15.000	14.800	12.000
14	No Market	21.500	94.000	15.000	14.800	12.000
16	21.200	21.625	94.000	15.000	14.800	12.000
17	21.200	21.650	94.000	15.000	14.800	12.000
18	21.200	21.600	94.000	15.000	14.800	12.000
19	21.200	21.525	94.000	15.000	14.800	12.000
20	21.200	21.425	94.000	15.000	14.800	12.000
21	No Market	21.425	94.000	15.000	14.800	12.000
23	Holiday	21.425	Holiday	Holiday	Holiday	Holiday
24	21.200	21.575	94.000	15.000	14.800	12.000
25	21.200	21.600	94.000	15.000	14.800	12.000
26	21.200	21.575	94.000	15.000	14.800	12.000
27	21.200	21.500	94.000	15.000	14.800	12.000
28	No Market	21.500	94.000	15.000	14.800	12.000
	AVERAGES FOR MONTH					
Feb.	21.200	21.507	94.000	15.000	14.800	12.000
	AVERAGES FOR WEEK					
4	21.200	21.508	94.000	15.000	14.800	12.000
11	21.200	21.479	94.000	15.000	14.800	12.000
18	21.200	21.558	94.000	15.000	14.800	12.000
25	21.200	21.496	94.000	15.000	14.800	12.000
	CALENDAR WEEK AVERAGES					
7	21.200	21.496	94.000	15.000	14.800	12.000
14	21.200	21.463	94.000	15.000	14.800	12.000
21	21.200	21.542	94.000	15.000	14.800	12.000
28	21.200	21.529	94.000	15.000	14.800	12.000

Silver, Gold and Sterling

DAILY AND AVERAGE PRICES

Feb. 1948	Sterling Exchange "Checks"	Silver (c): New York	Silver (c): London	Gold: London	Gold (d): United States
2	402.500	74.625	45.000d.	172s. 3d.	$35.000
3	402.500	74.625	45.000d.	172s. 3d.	35.000
4	402.500	74.625	45.000d.	172s. 3d.	35.000
5	402.750	74.625	45.000d.	172s. 3d.	35.000
6	402.500	74.625	45.000d.	172s. 3d.	35.000
7	(c)	(c)	(c)	(c)	35.000
9	402.500	74.625	45.000d.	172s. 3d.	35.000
10	402.500	74.625	45.000d.	172s. 3d.	35.000
11	402.500	74.625	45.000d.	172s. 3d.	35.000
12	Holiday	Holiday	45.000d.	172s. 3d.	Holiday
13	402.500	74.625	45.000d.	172s. 3d.	35.000
14	(c)	(c)	(c)	(c)	35.000
16	402.500	74.625	45.000d.	172s. 3d.	35.000
17	402.500	74.625	45.000d.	172s. 3d.	35.000
18	402.500	74.625	45.000d.	172s. 3d.	35.000
19	402.500	74.625	45.000d.	172s. 3d.	35.000
20	402.500	74.625	45.000d.	172s. 3d.	35.000
21	(c)	(c)	(c)	(c)	35.000
23	Holiday	Holiday	45.000d.	172s. 3d.	Holiday
24	402.500	74.625	45.000d.	172s. 3d.	35.000
25	402.500	74.625	45.000d.	172s. 3d.	35.000
26	402.500	74.625	45.000d.	172s. 3d.	35.000
27	402.500	74.625	45.000d.	172s. 3d.	35.000
28	(c)	(c)	(c)	(c)	35.000
	AVERAGES FOR MONTH				
Feb.	402.514	74.625	45.000d.	—	$35.000
	AVERAGES FOR WEEK				
4	402.500	74.625	—	—	—
11	402.550	74.625	—	—	—
18	402.500	74.625	—	—	—
25	402.500	74.625	—	—	—

Calendar week averages, New York Silver: Feb. 7th, 74.625; 14th, 74.625; 21st, 74.625; 28th, 74.625.

(c) No market (Saturday).

THE above quotations for major non-ferrous metals are our appraisal of the important United States markets, based on sales reported by producers and agencies. They are reduced to the basis of cash, New York or St. Louis. All prices, except gold and silver, are in cents per pound.

(a) Net prices at refineries on Atlantic seaboard. To arrive at the delivered New England basis add 0.300c. per pound, the average differential for delivery charges.

(b) Our export quotation for copper reflects prices obtaining in the open market and is based on sales in the foreign market reduced to the f.o.b. refinery equivalent, Atlantic seaboard. On f.a.s. transactions we deduct 0.075c. for lighterage, etc., to arrive at the f.o.b. refinery quotation.

Copper, lead and zinc quotations are based on sales for both prompt and future deliveries; tin quotations are for prompt delivery only.

Quotations for copper are for the ordinary forms of wirebars and ingot bars; cathodes are sold at a discount of 0.125c.

Quotations for zinc are for ordinary Prime Western brands. Zinc in New York commands a premium over the St. Louis basis equal to the freight differential. Contract prices for High Grade zinc delivered in the East and Middle West in nearly all instances command a premium of 1c. per pound over the current market for Prime Western but not less than 1c. over the *Engineering and Mining Journal's* average quotation for Prime Western for the previous month; the premium on Special High Grade in most instances is 1¼c.

Quotations for lead are for common lead.

(c) Determined by Handy & Harman on the basis of market prices for bar silver, in cents per troy ounce .999 fine, in amounts of 50,000 oz. or more, nearby delivery, New York. Price quoted is in cents and one-eighth cent fractions, and is usually about one-quarter cent below the market to allow for delivery, carrying, and marketing. In addition to foreign silver, the quotation also applies to domestic and Treasury silver if such silver enters into the market. The Treasury's purchase price of newly mined domestic silver 90.5c. per troy ounce 1000 fine, effective July 1, 1946. London silver in pence per troy ounce, basis .999 fine.

(d) U. S. Treasury's gold price. Actual payment by the United States Treasury for gold in domestic and imported ore or concentrate is at 99.75 per cent of the price quoted by the Treasury, which is equal to $34.9125.

MARKETS—Trends and Prices

Miscellaneous Metals

(Monthly Averages)

Average prices of miscellaneous metals for January and February.

	Jan.	Feb.
Quicksilver, N. Y. flask	78.308	76.409
Antimony (a)	36.082	36.120
Antimony, bulk, Laredo	33.000	33.000
Antimony, in cases, Laredo	33.500	33.500
Antimony, Chinese (b)	.....	.....
Platinum, oz. troy	66.000	68.864
Cadmium (c)	175.000	175.000
Cadmium (d)	177.500	177.500
Cadmium (e)	180.000	180.000
Aluminum ingot	15.000	15.000
Magnesium	20.500	20.500

(a) New York, packed in cases, in lots of 5 tons or more but less than a carload. (b) Nominal. (c) Producer's price for commercial sticks. (d) Average producers' and platers' quotations. (e) Special shapes sold to platers.

E. & M. J. Weighted Index of Non-Ferrous Metal Prices

100 is composite for 1922-3-4. (Copper, Lead, Zinc, Tin, Silver, Nickel, Aluminum)

1938	73.67	1943	88.74
1939	77.71	1944	88.74
1940	79.22	1945	90.86
1941	83.49	1946	110.06
1942	86.80	1947	149.46

	1946	1947	1948
January	96.42	140.88	154.20
February	96.42	140.42	155.63
March	96.42	150.71	.....
April	96.42	153.14	.....
May	96.42	154.03	.....
June	107.16	150.05	.....
July	117.11	148.73	.....
August	113.32	149.35	.....
September	113.32	150.80	.....
October	114.25	151.05	.....
November	131.23	151.92	.....
December	142.19	152.48	.....

Official London Prices

Since Dec. 18, 1939, the British Ministry of Supply has named maximum delivered prices for the major non-ferrous metals. Prevailing delivered prices for consumers in the United Kingdom follow:

	Per Long Ton £	s.	d.
COPPER:			
Electrolytic, high conductivity	132	0	0
Fire refined, high conductivity	132	0	0
Fire refined, high grade	131	10	0
Fire refined, min. 99.2 percent	131	0	0
Fire refined, min. 99.7	130	10	0
Hot rolled black wire rods	138	0	0
LEAD:			
Soft, foreign, duty paid	90	0	0
Soft, Empire	90	0	0
English refined	91	10	0
ZINC:			
Foreign (G.o.b.), duty paid	75	0	0
Domestic (G.o.b.)	75	0	0
Prime Western and debased	75	0	0
Refined and electrolytic	75	15	0
Minimum 99.99 percent	77	5	0
TIN:			
Ingot, 99 percent	519	0	0

Miscellaneous Metals, Ores, Minerals

Quotations cover wholesale lots, prompt shipment, f.o.b. New York, unless otherwise stated

MISCELLANEOUS METALS

(February 28, 1948)

Aluminum, ingot, 99 plus percent, lb. (base price)	15c
Antimony, spot, lb., 5 tons and up but less than carload, in cases	36.12c.
Bismuth, ton lots, lb.	$2.00
Cadmium, commercial sticks, lb.	$1.75
Calcium, lb. ton lots, 98 percent, cast	$1.85
Chromium, 97 percent grade, lb., spot	92c.
Cobalt, 97 to 99 percent, per lb.	$1.65
Indium, troy oz.	$2.25
Nickel, electrolytic cathodes, lb., f.o.b. Port Colborne	33¾c.
Magnesium, 99.8 percent, carloads, lb., producer's plant	20½c.
Palladium, troy oz.	$24.00
Platinum (Official quotation wholesale lots) troy oz.	$69.00
Quicksilver, flask of 76 lb., 25 flasks or more	$76.00
Selenium, 99.5 percent, lb.	$2.00
Silicon, minimum 97 percent, spot, carloads, lb.	14.75c.
Tellurium, lb.	$1.75 nom.
Thallium, 100 lb. or more, lb.	$15.00
Titanium, 96 to 98 percent, lb.	$6.00@$7.00

METALLIC ORES

Beryllium Ore, 10 to 12% BeO, f.o.b. mine, per unit	$16.00@$18.00
Chrome Ore, per long ton, f.o.b. cars Atl. ports, dry 48% Cr_2O_3, 2.8 to 1 ratio	$34.00@$35.00
48% Cr_2O_3, 3 to 1 ratio	$38.00@$41.00
Iron Ore, Lake Superior, Lower Lake ports, long ton:	
Old Range bessemer	$5.95
Mesabi bessemer	$5.70
Old Range non-bessemer	$5.80
Mesabi, non-bessemer	$5.55
Lead, (Galena) 80 percent, Joplin, Mo., ton	$195.65
Manganese Ore — Per long ton unit of Mn, basis 48 per cent manganese, subject to premiums and penalties, f.o.b. cars Atlantic and Gulf ports, duty paid, 65@70c.	
Molybdenum Ore, 90%, per lb. of MoS_2 f.o.b. mines	45c.
Tungsten Ore, per unit of WO_3:	
Foreign, 60 percent, duty paid	$29.00@$30.00
Domestic, scheelite, 60 percent and upward	$30.00
Vanadium Ore, per lb. of contained V_2O_5 f.o.b. mines	27½c.
Zinc Ore, Prime, 60 percent concentrate, Joplin, Mo., per ton	$78.00

METALLIC COMPOUNDS

Arsenious Oxide (arsenic trioxide) lb., in bbl., carload lots, delivered	6¼c.
Cobalt Oxide, 70 to 71 percent, lb., ceramic grade	$1.27½
Copper Sulphate, 100 lb.	$7.60

ALLOYS

Beryllium Copper, 4 percent Be, per lb. of contained Be	$20.50
Ferrochrome, 65 to 69 percent, per lb. of Cr contained	18.60c.
Ferromanganese, 78 to 82 percent, gross ton	$145.00
Ferromolybdenum, 55 to 65 percent Mo, lb of Mo, contained	95c.
Ferrosilicon, 50 percent, per lb. of contained Si	8.80c.
Ferrotungsten, 75 to 80 percent, lb. of W contained	$2.25
Ferrovanadium, per lb. of V delivered	$2.90
Silicomanganese, 1½ percent C, per lb. contracts	7.80c.

NON-METALLIC MINERALS

Asbestos, f.o.b. Canada (Quebec) mines (U.S. funds), ton:	
Crude No. 1	$800
Crude No. 2	$302@$410
Spinning fibers	$170@$230
Paper stock	$43@$65
Shorts	$20@$38
Vermont, f.o.b. Hyde Park:	
Shingle stock	$97.00@$107.00
Paper stock	$68.50@$85.00
Waste	$51.00
Refuse or shorts	$25.50@$46.50
Barytes, f.o.b. mines:	
Georgia, crude, per long ton	$11.50@$12.00
Missouri, 93 to 94 percent $BaSO_4$, per short ton	$9.00@$9.50
Bauxite, long ton:	
Domestic, crude, 50 to 52 percent (not dried)	$4.00@$5.00
Domestic, chemical, 55 to 58 percent	$7.50@$8.50
Domestic, abrasive, 80 to 84 percent	$16.50
China Clay, f.o.b. mines, ton:	
South Carolina and Georgia, No. 1, airfloated, bulk	$6.75@$8.00
Maryland, ball, bulk	$7.00@$9.00
Feldspar, bulk ton:	
Potash feldspar, 200 mesh	$17.00
Glass spar, white, 20 mesh	$11.75
Fluorspar, f.o.b. mines, bulk, Kentucky and Illinois 70 percent, all rail movement, ton	$35.00
Acid 97 and 1 percent, bulk, ton	$40.00
Fuller's earth, f.o.b. Georgia or Florida, ton	$7.00@$14.00
Magnesite, per ton dead-burned, f.o.b. Washington	$24.00
Mica — Domestic f.o.b. mines. Punch, 6 to 15c. per lb. according to size and quality. Sheet, clear, 1½x2 inch, 60 to 65c.; 2x2 inch, 95c. to $1; 2x3 inch, $1.35; 3x3 inch, $1.80; 3x4 inch, $2.25; 3x5 inch $3; 4x6 inch, $4; 6x8 inch, $6. Wet ground, very fine, $110@$155 per ton. Bulk sales, dry ground, $40@$80 per ton. Scrap, $25 and up.	
Ocher, Georgia, ton, in sacks	$24.00
Pyrites, Spanish, per long ton unit of S, c.i.f. Atlantic ports	12@14c.
Sulphur, Texas, mines, long ton	$16.00@$18.00
Talc, f.o.b. works, ton:	
New York, purified	$18.50@$20.00
Vermont, extra white	$12.50
Tripoli, Missouri, ton:	
40 mesh, cream colored	$14.50

IRON AND STEEL

Pig Iron, Valley furnaces, gross ton: Basic	$39.00
Steel, baseprice, Pittsburgh Bilets, net ton	$46.00
Structural shapes, 100 lb.	$2.80

WASHINGTON REFLECTIONS

McGraw-Hill Washington News Bureau

MMSW Union Jeopardized by Communist Influence

The National Labor Relations Board's interpretation of the representation rights of unions which have not qualified under the Taft-Hartley labor law has raised a double-barreled threat to the status of the Mine, Mill & Smelter Workers, CIO.

Officers of this union have not filed the non-communist affidavits which would entitle it to protection from NLRB. As a result:

1. NLRB will not entertain an employer petition to determine whether this union represents a majority of the employees. In the Remington Rand case, this was construed as the equivalent of decertification.

2. NLRB will, however, place a non-complying union on the ballot in response to a decertification petition filed by a group of employees who wish to remove the union as bargaining agent. This it did in a case involving the CIO Steel Workers.

A communist-tainted union which is certain it can win a "decertification" election may try to use the latter policy to its advantage in this way: it may arrange for a group of workers to petition for such a poll and win it. Although NLRB would not issue a certification, no other election could be held for at least a year because the new law permits not more than one valid poll a year. In this way the union could block certification for 12 months of any rival union.

The CIO Electrical Workers, involved in the Remington Rand dispute, has taken particular care to avoid a similar tussle over representation rights with other employers with whom it has had contracts. At Phelps Dodge Copper Products Corp., Bayway, N. J., for example, it obtained an agreement to continue the contract for another year while wage negotiations continued beyond the March 8 expiration.

Non-complying unions are vulnerable to raids by those unions which may use the Taft-Hartley law to their advantage. The usual situation will find an AFL craft union seeking to carve a piece out of a plant-wide CIO bargaining unit. If the AFL can persuade the NLRB to split the unit, it stands a good chance of moving in.

An attempt of this nature was made by the AFL Electrical Workers at Scovill Manufacturing Co., Waterbury, Conn., where MMSW has held bargaining rights covering all production and maintenance workers.

The AFL sought representation for employees in only two departments – (1) steam and (2) construction and maintenance–which were part of the larger group under CIO jurisdiction. MMSW might have lost bargaining rights over these workers if NLRB had not decided that it would be inappropriate to split the bargaining unit.

During the last year of the Wagner Act, the NLRB conducted 37 bargaining elections and cross-checks of payrolls in metal mines. Twenty-eight resulted in union victories – 18 by the CIO, 10 by the AFL, and two by independent unions. There were 2,882 votes cast out of a possible 3,310.

Large Alaskan Program Is Under Consideration

A five-year plan for Alaska, backed by a nine-figure budget, is to be proposed to Congress shortly by a Government inter-agency committee. This will advance development of natural resources, health, education, and transportation in the territory.

The committee studied the needs of the territory last summer and made a series of reports to the President on what is needed in the way of aid and development. Although the plan and the reports covering the needs of the territory have not yet been revealed, it has been intimated that the resources development program will be extensive.

Minerals and the use of land will be among the principal items to be developed under the program. Several governmental agencies, including Interior, Agriculture, Commerce, National Defense, Interstate Commerce and Maritime Commissions, and the Federal Power Commission, will have a hand in the development work.

What will happen to the plan – and the appropriation – in Congress, where anything new costing money faces an uphill road, is very uncertain. It is probable that the plan will be approved, but the appropriation with which to carry it out will be pigeonholed until next year.

Modification of Russell Bill Is Expected Soon

The problem of presenting to Congress an acceptable bill providing incentives for mineral production seems to have both Washington and the industry baffled. There are indications, however, that a bill will be offered soon.

By the end of February on Capitol Hill there had been no decision on, or even a decisive move toward, legislation to give help to marginal producers. Late in February, representatives of several mining districts met with Representative Chas. H. Russell of Nevada to discuss possible changes in the Russell Bill (H.R. 2455). Several of those present intimated that the bill would not be greatly modified. Manganese would probably be added to copper, lead and zinc, and all other minerals on the stockpile list would be added at the discretion of the director of the subsidy program. Provision was contemplated for adding production fostered by the measure to the stockpile.

Representative Lemke's public lands subcommittee on mining currently is running a series of hearings on the problems of strategic and critical materials producers. This will eventually end up with the conclusion that a subsidy is needed for national defense.

On the other side of the Congress, Senator George W. Malone's national resources economic subcommittee of the Committee on Interior and Insular Affairs has been attacking the problem from the tariff side of the picture. The subject of subsidies will probably come up before the group sometime in the future. The present aim seems to be the building of evidence on which to oppose renewal of the Reciprocal Trade Act.

The Snyder Plan, which establishes a sliding scale of payments for production of copper, lead, and zinc, favoring small producers on an automatic basis with the only administrative check being a Treasury audit, has been the most widely endorsed of any subsidy idea so far. The plan, however, is not viewed as acceptable in Washington because Government, by the very nature of its operations, has always maintained supervision over any wholesale expenditure of public funds.

The Bureau of Mines has been studying the incentive problem for some time. It has not come up with any suggestions so far, however.

Contrary to stories circulated throughout the country, Dr. James Boyd, Director of the Bureau of Mines, did not commit the Interior Department to any subsidy plan. Dr. Boyd, appearing before the House public lands subcommittee hearings on manganese, was asked: "If we have a shortage of manganese, and find domestic production must be supported by a subsidy, is it not the best idea to place the material resulting from the incentive in the military stockpile?"

The Director answered that, if a subsidy were necessary for national defense, the logical thing would be to place the results of the plan in the stockpile. This could hardly be called advocacy of a subsidy for mining.

It is the general opinion in Washington that if subsidy legislation is aimed at national defense and provides for stockpiling the resulting production, President Truman will not veto the measure as he did the Allen bill.

Budget Surplus Foreseen Despite ERP and Tax Cut

If a Congressional staff of fiscal experts is right, the Government will be able to reduce the national debt by more than $13,000,000,000 in the next two fiscal years.

The Treasury now says there will be a budget surplus in fiscal 1948 (July 1) of $7,000,000,000. The Congressional experts say it will be close to $8,000,000,000.

The Treasury says that in fiscal 1949 there will be a budget surplus of $4,200,000,000. The Congressional staff says it will be $7,000,000,000.

Reworking the figures to include transfer of $3,000,000,000 from the 1948 to the 1949 budget for the ERP, the answer comes out a surplus of $5,000,000,000 for 1948. The transfer of the ERP account ($3,000,000,000) to the 1949 budget makes a total surplus of $10,000,000,000 (using Congress' figures). Adding to that figure a budget cut of $2,500,000,000 and subtracting the cost of a tax cut ($4,000,000,000), leaves a final total surplus for fiscal 1949 of $8,500,000,000. The two years added together gives $13,500,000,000 for reduction of the national debt.

Mine Loans Omitted from Subcommittee's RFC Bill

Mine loans have not been specifically provided for in the extension of the Reconstruction Finance Corporation as recommended by the Senate banking subcommittee.

Senator Zales N. Ecton, chairman of the mining and minerals subcommittee of the Senate Small Business Committee, had asked Senator C. Douglass Buck, chairman of the banking subcommittee, to consider a mine loan provision in any new RFC legislation. He pointed out that repeal of section 14 of the old law had resulted in cessation of all loans for mining development purposes. He was advised that Senator Buck would consider the idea.

Nevertheless, the subcommittee report does not make any such provision. Now, it will be up to the main Banking and Currency Committee membership to make the addition.

Under the recommended bill as it now stands, any mine loans would have to be handled through the regular business loan procedure. This would require that the loan "be of such sound value or so secured as to reasonably assure retirement or repayment." This clause eliminates venture capital loans.

The subcommittee recommended that the life of the RFC should be extended for ten years – with its lending power cut in half. It also recommended that the agency's capital and surplus, which now total $875,000,000, should be cut to $150,000,000, with the difference reverting to the Treasury.

Under present law the agency would die next June 30. The new bill would extend its life to June 30, 1958, and allow two additional years for liquidation. It would set a $1,000,000,000 ceiling on loans, investments and other commitments outstanding.

The agency, under the new proposal, could not guarantee more than 65% of a bank loan of less than $100,000 or more than 50% of a larger loan. The present law allows a 90% guarantee.

Bureau of Mines Hopeful for Titanium and Zirconium

Two light metals, heretofore used by industry only in small quantities, are now in experimental production at Government pilot plants. Both are believed to have great promise. They are titanium and zirconium.

Titanium, half as heavy and twice as strong as unalloyed low-carbon steel, is less than twice the weight of aluminum, and is twice as strong. In addition to its strength, the metal is not affected by salt water or salt air, and is very resistant to other corrosion.

Because of the resistance to salt water, the Navy is now experimenting with pontoons, cables and wing coverings made of titanium. Zirconium, about three times the weight of aluminum but lighter than steel, is expected to compete with stainless steel, tantalum and stellite, particularly in turbine blades. Its corrosion-resistant properties, combined with high strength, make it a natural for turbines. Corrosion has been one of the hardest problems to solve in the turbine field.

The two have only recently been produced as pure metal in any quantity. The U. S. Bureau of Mines now can turn out 100 pounds of titanium and 65 pounds of zirconium a day. The titanium pilot plant is located at Boulder City, Nevada, and the zirconium plant at Albany, Oregon. The Boulder City plant will be expanded to a capacity of one ton a day, budget permitting, this year.

Production costs for the newcomers – $4 a pound for titanium and slightly more for zirconium–are still uncompetitive for major uses, but as technology and research continue the price will drop.

The Bureau is doling out samples of titanium to industry, various research institutions, and the Navy, under cooperative research agreements whereby any developments on use of the metal are exchanged. Applications of the metal in structures, dentures, springs, hard-surface materials, pontoons, cables, and wing coverings for airplanes are being carried on at present.

Experimentation with zirconium is about a year behind that on titanium, but some metallurgists are already confident that it eventually will replace other materials in such fields as corrosion-resistant vessels, turbines, and surgery.

Boyd Appointment in Jeopardy

The appointment of Dr. James Boyd as Director of the United States Bureau of Mines seems quite likely to be tabled indefinitely by the Senate. Inasmuch as Boyd has been serving without pay since the first of the year and has offers elsewhere, he cannot afford to continue his present status much longer.

The fly in the ointment is Senator Millikin, of Colorado, who is a member of the Committee on Interior and Insular Affairs, which is considering the nomination. Millikin is not up for re-election until two years hence. It is not clear whether his servility to the views of John L. Lewis in blocking this meritorious appointment is due to concern over coal miner pressure in Colorado, to the desire of a Senate clique to oblige Lewis, or to some other influence.

As we have stated before, Boyd is unusually able and has made friends wherever he has gone. He is simply the innocent bystander in a grudge fight between Lewis and Krug, and the contention that he is disqualified because he is not experienced in coal-mine safety is a mere pretext. Nobody is qualified by experience in all Bureau of Mines activities. Having been previously appeased, the arrogant boss of the coal-mine union has the idea that his approval of this appointment is necessary before proceeding.

If the Senate bows to this viewpoint, it will do the Bureau of Mines and the mining industry an injury that will not be healed for many a day. Self respecting, able engineers will be reluctant to work in an agency so evidently controlled from behind the scenes by a union boss, and the morale of the Bureau will be seriously impaired. The industry will know that a man universally endorsed by it was rejected because of Lewis' oposition. With the agency most directly affecting mining reduced to subserviency to Lewis, the industry can contemplate with dismay who rules its roost in Washington, and the implications of this situation for the future. Regardless of wishes, pro or con, all signs point to Washington having a growing share in mining industry affairs. The industry should be greatly concerned with the kind of administration the Bureau receives, and with the possibility of its being a political football.

If you care enough about your industry or the Bureau of Mines, now is the time for action. Write your senators and Senator Millikin and let them know what you think about their chaining the Bureau to the chariot wheel of a power-mad boss whose contempt for the public interest has been repeatedly demonstrated.

NEWS OF THE INDUSTRY

A. I. M. E. Board of Directors Vote Establishment of Minerals Beneficiation Division at Annual Meeting

Gold, described by the proponents of managed economy as a useless commodity, was the most discussed subject at the Annual Meeting of the American Institute of Mining and Metallurgical Engineers in New York during the week of Feb. 15. That the mining industry does not hold with the viewpoint of the planners was evinced by two papers presented at the mineral economics session, which brought the largest attendance of any of the technical sessions and spirited discussion from the floor.

Speaking on "What Price Gold," a paper by R. H. Bedford, Arthur Notman, consulting engineer, foretold a retreat from managed currencies to gold-redemption currencies after inflation and devaluation, also a higher gold price. Donald H. McLaughlin, president of Homestake Mining Co., recommended the checking of inflation by free circulation of gold coins stamped with weight but not value. This procedure would check further inflation of the dollar, and the dollar level at which this coinage would stay in circulation would indicate the logical price for gold.

Boyd Outlines Mineral Policy

Dr. James Boyd, director of U. S. Bureau of Mines, sketched recent mineral policy developments in Washington, indicating his hopes for better policies through the industry advisory committees recently set up. A. Lysle Belsley, secretary to the National Security Resources Board, described the purpose and functions of the Board, stressing its advisory status and the hope of solving emergency needs in advance. R. P. Koenig, president, Ayrshire Collieries Corp., spoke on "Mineral Problems of the European Recovery Program." He pointed out the major importance of Western Europe as a mineral-consuming area and the necessity of industrial rehabilitation. Mineral needs for such rehabilitation can be met without injury to domestic economy.

Andrew H. Phelps, vice-president of Westinghouse Electric Corp., presented "A Consumer's Viewpoint on Tariff." He maintained that raw-material tariffs are beneficial to consumers and preferable to any other form of subsidy. Evan Just, editor of *Engineering & Mining Journal*, in discussing "Subsidies for Domestic Mine Production," analyzed subsidies as dangerous from an industry viewpoint but probably necessary in future for the maintenance of mineral industries large enough for national security, considering that adequate tariff protection for this purpose would meet increasing resistance.

Speaking on "Military Strategy and Minerals," Col. G. A. Lincoln, U. S. Military Academy, pointed out the broad industrial base on which security rests, the importance of minerals to security, and our dependence on foreign sources for many essential minerals necessitating stockpiling as an essential security measure.

Form New Milling Division

Highlight of the meeting, as far as millmen were concerned, was the transformation of the Milling Methods Committee into the Minerals Beneficiation Division. Long sought by the Milling Committee, and recommended by a committee appointed by the Institute to study the problem, the new division was created by vote of the A. I. M. E. board of directors on February 16. J. F. Myers will be 1948 chairman.

The objective of the Minerals Beneficiation Division will be to provide better interchange of technical information among mill men in the several commodity fields.

In the technical sessions, Rush Spedden's movies of minus-48-mesh galena particles striking, and being collected by, air bubbles in a xanthate solution reopened an old argument. Taken at the terrific speed of 3,000 frames per second, these movies showed that mineral particles can sneak in and grab at a bubble from behind, so to speak. The argument arose over the question of whether the action pictured resembled that of a bubble in a pneumatic machine or in a mechanical machine; the "coursing bubble" vs. the "gas precipitation" hypotheses, in other words.

In an open forum discussion on thickening and filtering, which ran for a day and a half, E. J. Roberts led off with a paper on recent progress in thickener calculations. Discussion brought out the fact that empirical methods still play a large part in thickener design. Much discussion centered on centrifugal vs. diaphragm pumps for handling thickener underflow, Myers, of Tennessee Copper, reporting that his plant uses a centrifugal pump on a flotation concentrate that is 80% minus-200-mesh and has been thickened to about 80% solids. Specific gravity of the mineral is 4.4.

M. G. Driessen, inventor of the D. S. M. cyclone separator, described the device (*E.&M.J.*, December, 1947.) and its possibilities as a thickener. Among other things, he reported that his cyclone develops a centrifugal force on particles being treated of about 2,000 times gravity.

In a session on grinding, E. H. Crabtree, Eagle-Picher, told how his company saves about $40 per ton in cost of ferrosilicon medium for its Heavy-Media plant, by buying it in pig form and crushing and grinding it at the property.

T. E. Norman, of Climax, reported on a technique for speeding up comparative tests for wear of grinding balls. F. C. Bond, of Allis-Chalmers, described a study of means of keeping large balls up at the feed end of a ball mill.

Steel Used In Top-Slicing

Papers prepared by J. L. Bruce, G. W. Nicolson, and J. G. Tate described top-slicing methods at Cyprus Mines Corporation properties where steel posts and matting were employed in stopes. Steel deteriorated to the extent of 50% each year, and steel costs were about 5c. per ton mined.

Maximum drilling speed attained in oil shale at Rifle, Colo., during experimental work with percussion drills and hard-faced bits was 32 in. per min. according to a paper by Tell Ertl and E. E. Burgh, U. S. Bureau of Mines, who observed that drilling speed is directly proportional to the coarseness of cuttings produced. Prof. P. B. Bucky, Columbia University, and F. D. Wright, U. S. Bureau of Mines, described a method of determining room-and-pillar dimensions for oil-shale operations by testing specimens of supporting rocks involved. Tests showed that spans of 100 ft. with a factor of safety of four would be possible for certain areas at the Rifle mine where ample working room must be provided for 3-yd. shovels and 15-ton diesel trucks.

S. S. Clarke reported that the cost of operating diesel trucks at Eagle-Picher properties was 10c. per ton as compared with 18c. for battery trucks. He also stated that costs for diesel-powered loaders was 4c. per rock ton loaded, and 7c. per rock ton for electrically-powered loaders.

Tests with tungsten-carbide inserts in rotary bits at the Book Mine, Menominee Range, Mich., showed drill bit costs of $.082 per ft. as compared with $0.679 per ft. for diamond-drill bit costs.

Speed, and ability to function in warm drill holes, were the two chief advantages cited for the Tro-Pari gimbal-mounted, drill-hole survey instrument over hydrofluoric acid and gelatin-type instruments. The unit is controlled by a timing mechanism

which locks the compass needle and a plumbing device to indicate direction and dip.

In a discussion of drilling patterns at Eastern magnetite mines, John W. Koster, E. I. du Pont de Nemours & Co., described a 8½x12-ft. drift round which employed a five-in-line burn cut as one side of a vertical wedge cut which was used with success at the Fisher-Hill mine.

R. D. Longyear presented a paper prepared by B. H. Boyum, Cleveland-Cliffs Iron Co., on deflection diamond drilling with the Hall-Row wedging device. Field experience indicates that maximum deflection obtainable with the device is 1 deg. 50 min., and average for many holes is 1 deg. 6 min.

Industrial Minerals

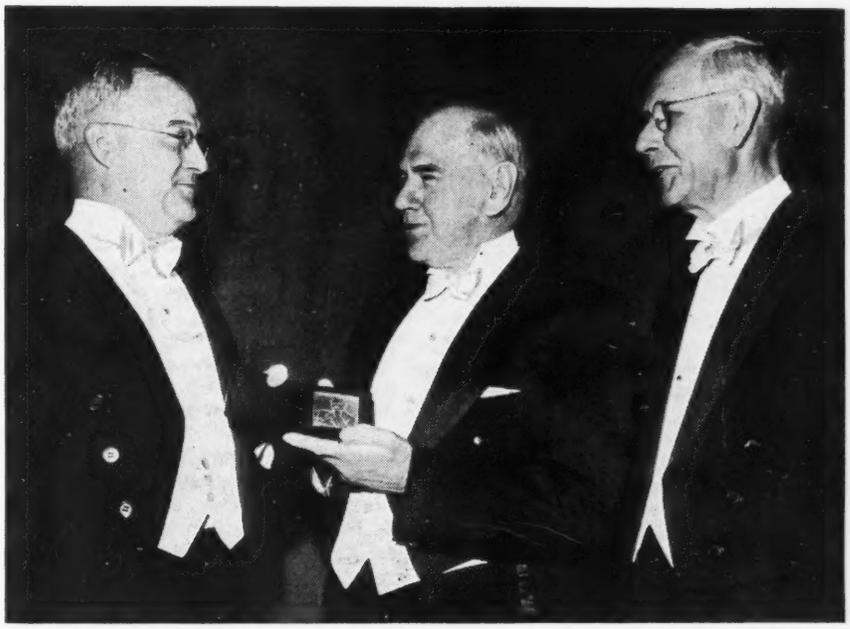
Heavy minerals occurring in the Trail Ridge, Florida, phosphate deposits was the subject of papers presented by F. R. Hunter, E. E. Creitz and T. N. McVay before the Industrial Minerals Session. A microscopic technique for identifying 500 grains in 15 minutes aroused considerable interest.

Apparatus for electrical dewatering of phosphate tailings involving the use of the principle of electrophoresis, developed by the T. V. A. Process Development Division, was described by E. C. Houston. A sheet cast-iron anode drum rotates continuously in a cathode cradle. Mill slurries are fed into the cradle and a cake forms on the anode as it passes through. Sodium hydroxide added to the slurry provides conductivity. Deposition rate is reported as 7 lb. per sq. ft. per hr. and power consumption at 65 kw. per ton. Although not found to be economically competitive with mud ponds, the difference is so small that with increasing cost of the latter, the process may soon displace them. Houston predicts drums 20 ft. long and 10 ft. in diameter to provide the necessary anode area.

A report of mineral resource investigations in southwest Oklahoma was made by W. B. Mather of Midwest Research Institute who conducted the survey. Interest in industrializing the state is high, in order to supplement petroleum production which now accounts for 87% of the state's mineral output.

Recent developments in mineral raw materials in the Pacific Northwest was the topic discussed by R. J. Anderson. National Lead is building a mill at Pocatello, Idaho, to treat barite mined in that state. Alcoa is studying bauxite deposits said to be similar to those of Arkansas. Kaolinite deposits are being investigated with the view of freeing the region's paper industry from dependence on Georgia. Limonite deposits may be developed for pigment use.

Except for Africa, no new asbestos deposits have been found in 15 years according to M. J. Messel in his paper on "Recent Trends in Asbestos Mining and Milling." This fact combined with the postwar expansion and failure to find a suitable synthetic substitute has created a shortage of the material that has forced the utilization of shorter fibres. Technological studies have improved on the ability to blend fibres in order to get greater utility of all grades. Emphasis in mining and milling methods is to recover more material rather than a maximum recovery of long fibres. Mill tails are being cleaned by air separation to recover short fibres. Old tailings dumps may be reworked. Bagging is an expensive item due to product bulkiness. A real boon to the industry would be the development of a new method of packaging.



EUGENE G. GRACE, chairman of the board of Bethlehem Steel Corporation, receives the A. I. M. E.'s Charles F. Rand Medal from retiring president Clyde Williams at the Institute's annual banquet. William E. Wrather, incoming president, stands to the right.

Geology and Geophysics

George M. Fowler, consulting geologist, discussed the preference of Tri-State district orebodies for specific beds and the localization of orebodies where shattering had occurred. Daniel R. Stewart, American Zinc, Lead & Smelting Co., renewed the case for descensionism in explaining Mississippi Valley mineralization, emphasizing the sufficiency of source materials in sedimentary rocks, particularly shales, and the uniform shallowness of the deposits. M. H. Frohberg, Macassa Mines, Ltd., described the Renabie Mine area, a new gold district in Western Ontario.

Speaking on "The Nature and Significance of Ribbon Quartz," H. E. McKinstry and E. L. Ohle, Jr., of Harvard University, emphasized its metasomatic origin. Harrison Schmitt, consulting geologist, discussed "Contact Pyrometasomatic Aureoles," emphasizing their importance and the possibility that gaseous transfer and meteoric waters were involved.

A monumental paper, delivered by Reno H. Sales and Charles Meyer, Anaconda Copper Mining Co., described the exhaustive studies of wall-rock alteration at Butte, made by the company's new geological laboratory. The conclusion was that argillization of the wall rock, then sericitization, went forward successively and simultaneously, there being no change in the character of the solutions throughout.

Ira Joralemon, consulting geologist, in documenting the case against have-not-ism, cited 38 finds in the last ten years not classifiable as routine extension of mine operations. These, he averred, found more metal content in ore than was extracted in the ten-year period.

T. P. Thayer, U. S. Geological Survey, et al., described the iron ore deposits of Western Liberia. Franklin G. Pardee, Michigan Geological Survey, estimated Michigan's low-grade iron ore reserves at nearly two billion tons per 100 ft. of depth and the shipping ore reserves at ¾ billion tons per 100 ft.

The sessions on geophysics were general discussions under two headings. In that on airborne vs. surface magnetic surveys, led by Theodore Koulomzine, consulting geologist-geophysicist, it was pointed out that anomalies broaden and merge with increasing altitude; thus the airborne instrument is essentially a reconnaissance tool. In the discussion on the carrying out of geophysical prospecting by geologists and prospectors vs. by professional geophysicists, opinion was divided. One group suggested that the field work could be done by non-experts if final interpretations could be handled by experts. The other insisted that expert attention is necessary throughout.

New York Chamber Advises Delaying Return to Gold

Subsequent to the French Government's devaluation of the franc, in late January, the New York Chamber of Commerce declared that a return to the gold standard at this time would be premature. Reporting the results of a year's study, the chamber's committee on finance and currency said that it would be wise to defer such a move until conditions in the world's monetary systems are less confused.

The Chamber has espoused sound monetary policy for nearly two centuries, and views a gold standard as "the most satisfactory monetary system from the standpoint of the American people as a whole." However, it points out that at present there is no basis for lack of confidence in the dollar as the gold reserve covers more than two thirds of money in circulation.

Mexican Government Holds National Mining Congress

During the week March 8-13 a national mining congress will be held at Mexico City under the auspices of the Ministry of Economy of the Mexican Government. The purpose is to develop and further policies looking toward maximum development of Mexico's minerals. The program will include all aspects of the mining industry. Subjects on the agenda are mining law, mining agencies, safety, expropriation, taxes, transportation, stimulation of production, cooperatives, labor relations, occupational disease, education, and market problems. All participating interests in the mining industry are eligible to attend.

Brownell Urges a Return To Free Markets in Gold

In late January, F. H. Brownell, board chairman of American Smelting and Refining Co., wrote a letter to the Congressional committees on banking and currency urging resumption of free markets in gold.

He recommended that legal restriction to private ownership of gold be removed, but advised continuation of the present obligation of the Treasury to buy gold offered at $35 per ounce.

Calling attention to the flow of over two billion dollars in gold to the United States in 1947 and the circumstance that this country possesses 60% of the world's monetary gold, Mr. Brownell pointed out the inflationary effect of the inflow on bank reserves and credit. The flow of gold into private hands, on the contrary, would be deflationary and would tend to equalize its distribution, thus hastening the day when other nations could return to some form of gold standard.

Senate National Resources Sub-Committee Hears Mining Problems at Denver Three-Day Session

Witnesses appearing before the Senate National Resources Economic Sub-Committee in Denver, Colo., February 3,4, and 5, were asked to submit evidence showing the mineral position of various states and districts, and to summarize factors vital to the healthy growth of the domestic mining industry. Senator George W. Malone, who conducted the sessions, also requested information on the effects of the recent Geneva tariff reductions.

In regard to tariffs, opinion of the witnesses was virtually unanimous that the Reciprocal Trade Agreements should be discontinued. Under cross-examination, most of them said they preferred to see the flexible Tariff Act of 1930 enforced, with revision by Congressional amendment to remove the President's discretionary powers to initiate changes in the tariff. Extensive evidence to prove that foreign production costs were relatively low was introduced by Otto Herres, W. W. Lynch, R. L. Ziegfeld, and S. H. Williston.

Incentive Payments

Opinion was divided on the need for incentive payments for production and exploration. Supporting the principle were: E. R. Shorey, Wisconsin, Illinois Iowa Zinc and Lead Producers Association; O. W. Bilharz, Tri-State Ore Producers Association; W. W. Lynch, Calumet and Hecla Consolidated Copper Co.; J. C. Kieffer, representing small operators in the Coeur d'Alene district; J. H. Taylor, Peru Mining Co.; Otto Herres, Combined Metals Reduction Co.; and Charles H. Dunning, representing Arizona operators. It was argued by several witnesses that tariffs based on average domestic costs give unnecessary protection to low-cost producers and none to high-cost producers, hence the need for incentive payments. It was further contended that incentives would bolster our national security and encourage conservation.

The principle of subsidies was opposed by Felix Wormser, St. Joseph Lead Co., and R. L. Ziegfeld, Lead Industries Association, who testified that an attractive price was the best incentive to production, and cited figures to show that lead production had not been curtailed by termination of Premium Price payments. Howard Young, American Zinc Lead and Smelting Co., said that subsidies are not justified under present economic conditions unless national defense authorities regard the production of certain low-grade ores as vital to national security.

SEC Amendment Proposed

Carl Trauerman, secretary, Montana Mining Association, reviewed the 15-year, nearly futile attempt of the mining industry to obtain reasonable concessions from SEC. He blamed the Mining Division of SEC for adverse decisions of the Commission, and recommended that the Mining Division employ a man who is familiar with primary mine financing. Attorneys Elmer Johnston, and Wellman Clark, of Spokane, Wash., proposed enactment of an amendment to the Exchange Act of 1934 which would permit the re-establishment of mining exchanges dealing in unlisted stocks. They further recommended a special exemption from registration under the Securities Act of 1933 which would apply to financing of ventures in the development and exploration of natural resources.

The number of producing domestic mercury mines decreased from 200 during the war to three at the close of 1947, according to S. H. Williston, who testified that the near collapse of the domestic industry was due largely to the importation of foreign metal. He cited the following possible remedies; anti-dumping laws; tariffs; application of anti-trust laws to foreign cartels; incentive payments; or a system of underground stockpiling under which the Government would pay producers two percent yearly on the value of proven ore blocked out and ready to mine.

Unfair tax laws were scored heavily by many witnesses, who requested revision which would allow write-offs for development and exploration, and would permit fairer distribution of losses during loss years over income years.

James K. Richardson, manager, Utah Mining Association, recommended that the Bureau of Land Management liberalize its conception of evidence of discovery to include any showing of mineral in rock in place "that would induce the locator to spend his time and money in working the claim with the expectation of finding commercial ore in place." He also urged provisions for the patenting of claims based on geophysical or geologic inference.

Donald McLaughlin, president, Homestake Gold Mining Co., challenged the contention that an increase in the price of gold would be inflationary. He maintained that the free circulation of gold at a higher price would simply be a recognition of the inflation that already exists. Free circulation of gold alone would not correct inflation, he added, but "nations would have to accept the discipline which it imposes."

Exhibits and testimony were introduced by representatives of various states and mining regions to establish the mining industry's appraisal of its own resources as compared with those indicated by Government reports.

Colorado Mining Meeting Is Clearing House For Informed Opinion on Industry Problems

More than 65 papers and addresses on national affairs, economics, and technology related to mining were delivered at the 51st Annual Meeting of the Colorado Mining Association in Denver, February 5, 6, and 7. During the same week more than 40 key representatives of mining districts and companies worked out an exploration and conservation incentive plan which was endorsed by the convention.

Commenting on the outlook for copper, W. W. Lynch, Calumet and Hecla Consolidated Copper Co., reported that "experts" were frankly puzzled by the unpredictable conditions governing the market. He criticized the buying terms of the Federal Bureau of Supply because it requires a firm offer, but specifies that the Government get the advantage of any price drop which might take place before actual shipment of copper. Although the Government refused to buy copper at 21½c. because the price was too high, Mr. Lynch pointed out that, Metals Reserve was first responsible for raising the price to 21½c.

Graded actual valuation freight rates were originally established to encourage the development of low-grade ore and place minimum freight on such ores, according to O. W. Tuckwood, general traffic manager, American Smelting and Refining Co. In times of rapidly increasing metal prices this formula does not work, he observed, and urged amendments to present freight tariffs which would remedy the penalties to shippers.

Discussing mine taxation, F. O. Davis, Potash Company of America, criticized the Johnson Amendment as being unfair because it permitted percentage depletion on certain minerals only. He recommended the adoption of a uniform depletion law applying to all metals and minerals produced at a mining property.

Participants in an oil-shale session, D. D. Potter presiding, were E. D. Gardner, Tell Ertl, H. P. Rue, and Boyd Guthrie, of the U. S. Bureau of Mines; Dr. Ben Parker, Colorado School of Mines; H. K. Savage and Frank Merrill. Discussion revealed that revised estimates indicate reserves of 300 billion barrels of liquid fuels in the oil-shale measures of Utah, Wyoming and Colorado, the latter state containing 90% of the total. Shale was reported to be a cheaper source for gasoline than coal. Several major oil companies are showing interest in the catalytic cracking of shale oil, and general progress of the new industry.

Domestic output of newly mined zinc for 1948 will probably total 650,000 tons if the current 12c. price on slab zinc continues, according to estimates of Howard I. Young, president of American Zinc, Lead and Smelting Co., who spoke on the "Outlook for Zinc Supplies and Requirements." This compares with the 1947 domestic production of recoverable zinc estimated to be 627,000 tons. Mr. Young reported that there "seems to be no let-up in consumption."

Although the per capita consumption lead of 15.8 lb. in 1929 remains nearly the same today (15.9 lb. in 1947), R. L. Ziegfeld, secretary, Lead Industries Association, reminded listeners that lead is in intense competition with other materials such as plastics, glass and stainless steel.

Speaking of "Relief to Small Operators," Dr. E. R. Shorey, University of Wisconsin, contended that conservation payments were more advantageous to producers than increases in price, because the increases persistently "shrink" by passing through the hands of the seller, the smelterman, and the millman before they are finally realized by the producer or operator.

Felix Wormser, St. Joseph Lead Co., emphasized that the "heart of the entire marketing system is the attitude of the ultimate consumer." In the absence of a metal exchange in this country comparable to that in London, Mr. Wormser said that sellers and buyers rely on the market journals which give specific trade information and quotations.

In a discussion on gold, Neil O'Donnell, Idaho-Maryland Mines Corporation, reported that gold mining has been in the doldrums largely because of mounting costs and scarcity of labor. As a remedy he proposed restoration of a free market for gold, and the rights of individuals to own gold, and to export it.

Donald McLaughlin, president, Homestake Mining Co., concurred with Mr. O'Donnell's proposals, adding that the Treasury might be authorized to produce coins stamped with their weight in gold, not in dollars, and return them to the producers after deducting seigniorage. Gold alone will not solve monetary problems, he observed, particularly when our Government persists in giving goods away under the guise of loans which will never be repaid. However, "gold is going to continue to be strong," he concluded, "since paper is getting weaker and weaker."

Mobil-Mills are now used to treat base metal ores, fluorspar, spodumene, anthracite coal, barite, galena, mixed sulphides and carbonate ores of lead, zinc, and silver; and hematite ores from the Iron Range, reported R. W. Hernlund, Western Machinery Co. Operating costs for the Mobil-Mill were estimated to be 33.6c. per ton for a mill operating at 20 tons per hr.

In an address, "The New Winning of the West," H. McClelland, vice president, Bank of America, San Francisco, summarized the rapid growth in population and industrial expansion in the Western States. He reported that during 1945, 1946, and the first half of 1947 nearly 5,000 projects to build or expand manufacturing plants were started in California alone, involving capital expenditures of more than $700,000.

Lack of adequate safety programs in small mines is largely responsible for the poor overall safety record of the mining industry, according to W. P. Morris, superintendent, International Minerals and Chemicals Corporation, Carlsbad, N. M. For 1946 he stated that frequency rates were as follows: large mines, 49.65; medium mines, 59.32; and small mines, 70.71. Severity rates for the same year were: large mines, 7.86; medium mines, 9.81; small mines, 13.96.

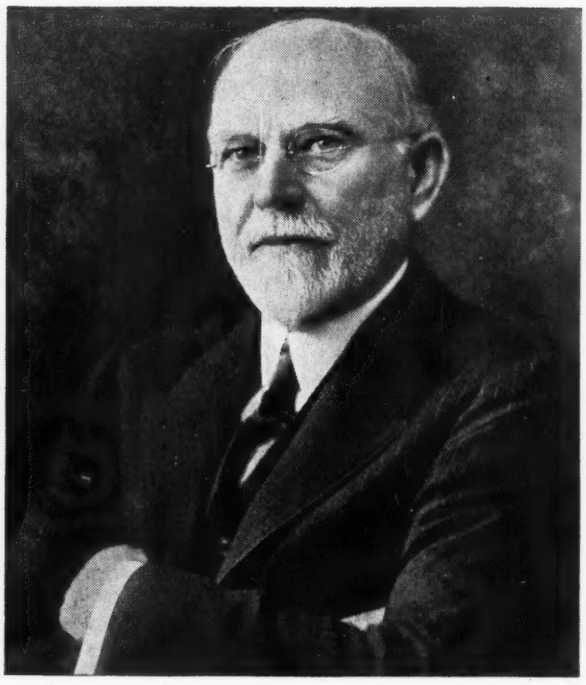
Geo-chemical prospecting, as applied to surface water, soils, and plants was discussed by V. P. Sokoloff. A map was exhibited to show various minute concentrations of copper and zinc in creeks near Kokomo, Colo. One significant anomaly appeared in Mayflower Gulch.

Although the recent case, United States vs. California, appears only to relate to title to mineral lands under tidewater in California, Senator Pat McCarran cited other Supreme Court decisions to show that question might easily arise as to title to mineral lands under all navigable waters in all states.

Premium Plan Approval

Several discussions were held during the hearing and meeting to iron out differences on subsidy legislation. More than 40 representatives of various districts and companies participated, and finally agreed upon a modification of a plan offered by E. H. Snyder. The plan avoids granting discretion to administrative agency, and provides for maximum payments on a sliding scale, beginning with a maximum of 7c. per lb. of metal on the first 250 tons of recoverable annual metal production and graduating down to 1½c. per lb. on tonnages in excess of 1,500. Payments could be used for exploration and development if the operator contributes one third of the total amount used for these purposes. Any remainder could be used by marginal operators to meet the difference between the market price and the cost of production, exclusive of overhead expense and depletion charges. Tri-State and Galena-Platteville operations would be restricted to a 1½c. per lb. "conservation payment" plus 7½% depletion and royalty, and exploration payments of one cent per pound of zinc sulphide equivalent.

Payment would be made by the Treasury on the basis of sworn statements of cost, subject to audit, except for operators producing less than 600 tons, who would simply file certified copies of settlement sheets. This plan was endorsed by the convention at large.



JAMES H. McGRAW

1860—1948

A LEADING FIGURE in the publishing field and dean of industrial publishers, James H. McGraw, Sr., died in San Francisco on Feb. 21. He started in 1884 as a subscription salesman and progressed through a colorful career to the head of the largest industrial publishing organization in the world, the McGraw-Hill Publishing Co., publishers of 26 national and eight international magazines, and, through its subsidiary, the McGraw-Hill Book Co., largest publishing house for technical and industrial books.

Born in southwestern New York, in 1860, he attended the State Normal School at Fredonia, and at the same time taught at a district school. On graduating in 1884, he was appointed principal of the latter. He had worked as a reporter for the hometown weekly, and in his spare time wrote for a monthly publication. When friends started "The American Journal of Railway Appliances," he succumbed to the temptation and made the decision which was to set the course of his life.

Leaving his country school, he went to New York to sell subscriptions. When the little publishing house got into difficulties and could not pay him, he was asked to help by finding some ready cash. With the confidence of youth, he raised $1,000 from a friend, took stock to this amount plus $1,500 owed him and became a vice president of the company. This was a turning point. Two years later the company paid a 10% dividend.

From this small beginning grew the McGraw Publishing Co. He broke with his partner over a difference of opinion regarding the importance of Edison's electric car. Mr. McGraw foresaw the doom of the horse-car and his first act as an independent publisher was to hire an electrical editor for his "Street Railway Journal." By 1901 he had acquired "Electrical World" and "Electrical Engineer," later consolidated as "Electrical World." Following these came "Engineering Record," "Chemical and Metallurgical Engineering" and "Electrical Merchandising."

Upon the death, in 1916, of John A. Hill, the McGraw Publishing Co. acquired the Hill publications, thereby adding "Engineering and Mining Journal," "American Machinist," "Power," "Coal Age," and "Engineering News," the latter being combined with "Engineering Record." The McGraw-Hill organization thus began with nine publications.

Mr. McGraw based the expansion of his publishing activities on the five major engineering professions and allied industries. Always, he was a pioneer. Just as he recognized the need for editorial independence and responsibility, he stood for frankness and honesty in circulation methods.

In 1929, the degree of Doctor of Commercial Science was conferred on him by New York University as "an educator transformed into a publisher, who has never ceased to be an educator." The Bok medal, presented annually as the Harvard Advertising Award, went to him in 1927.

The James H. McGraw Award was established in 1924 "to encourage constructive thinking for the advancement of the electrical industry."

Mr. McGraw was a Republican and was a delegate to the National Convention in 1904. For some years he was chairman of the New Jersey State Executive Committee of the YMCA, and was a generous benefactor of that organization. Mr. McGraw was a member of numerous societies and clubs.

In 1887 he married Mildred F. Whittlesey. They had four sons, James H., Jr., now president and chairman of the board of the McGraw-Hill company; Harold W., vice president in charge of the McGraw-Hill Building in New York; Curtis W., senior vice president and treasurer; and Donald C., vice president in charge of manufacturing. They also had a daughter, Catherine, now Mrs. John E. Osmun, of Madison, N. J.

He resigned in 1935 as chairman of the board, when his duties were taken over by his son, James H., Jr. Up to the last he maintained an alert interest in the company's affairs and in the work of the world.

SAFE DEPENDABLE POWER

Photo Courtesy Greensburgh Machine Co.

Haulage speeds up and costs go down when Exide-Ironclad Batteries supply the power

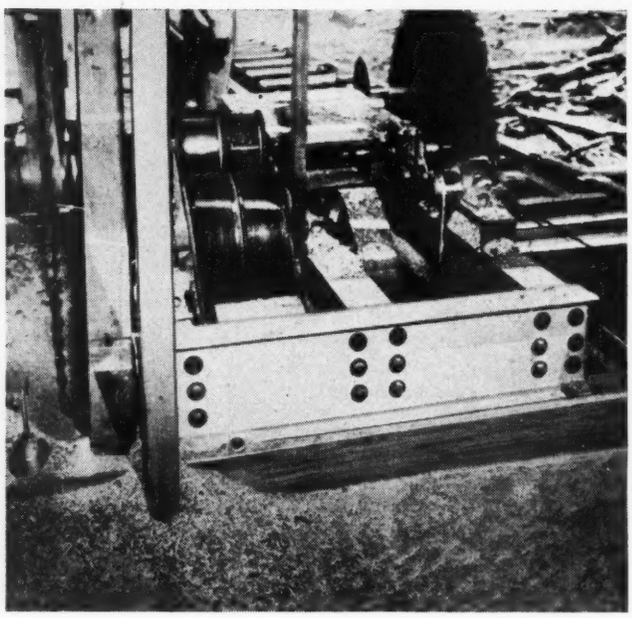
In more and more mines, quarries and tunnel operations, Exide-Ironclad Batteries are the preferred motive power for trammers, locomotives and shuttle cars. This preference is a result of their High Power Ability, High Electrical Efficiency, Ruggedness and Long Life—the four vital characteristics of a storage battery. Only Exide-Ironclad Batteries have all four.

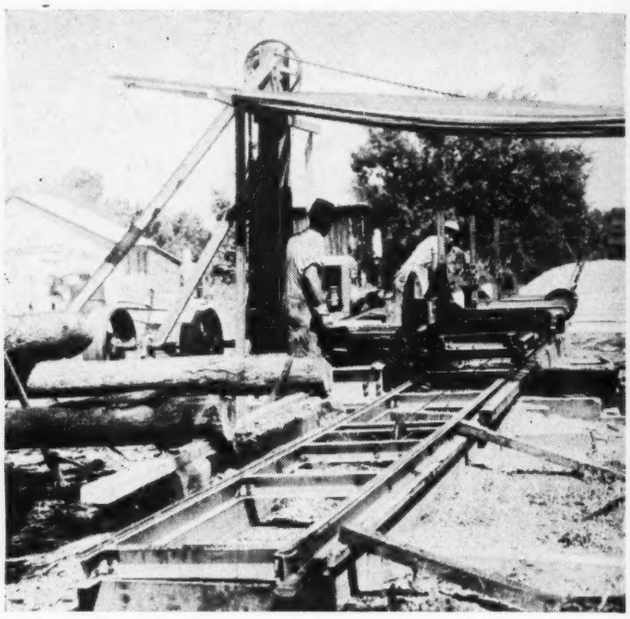
Exide-Ironclad Batteries differ from all others in performance because they differ in construction. One important difference is in the positive plate, which consists of a series of slotted tubes containing the active material. So fine are these slots that, while they permit easy access of the electrolyte, they retard the active material from readily washing out . . . thus assuring *years* of safe, dependable, day-in-and-day-out haulage service. The average life of all Exide-Ironclad Batteries renewed in locomotive and shuttle car service during the past year was 73.4 months.

If you have a special battery problem, or wish more detailed information, write for booklet Form 1982.

THE ELECTRIC STORAGE BATTERY COMPANY, Philadelphia 32 • Exide Batteries of Canada, Limited, Toronto

OPERATING IDEAS

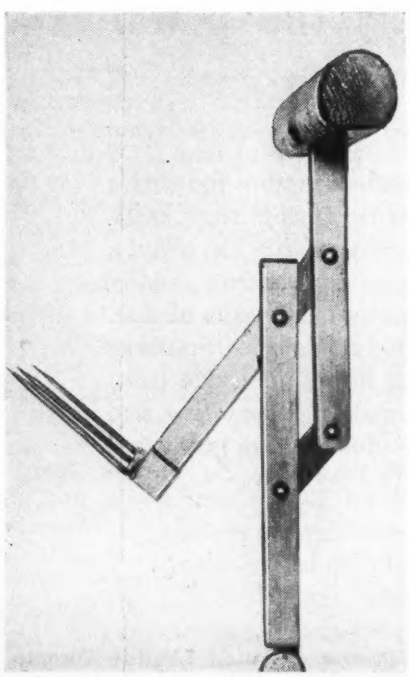


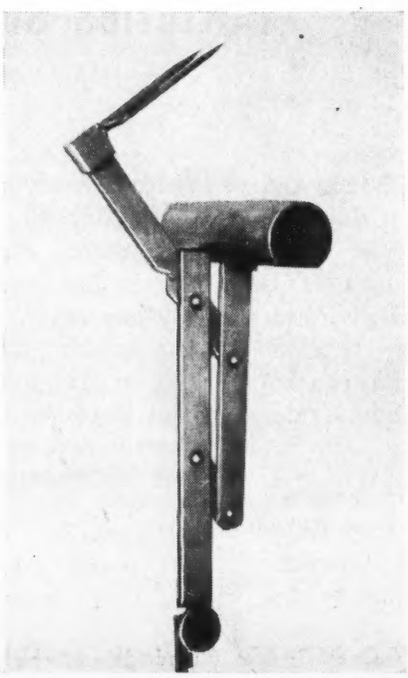


Portable Sawmill Constructed of Aluminum

Aluminum was used to construct this lightweight, portable sawmill. The carriage of the mill, which can handle 16-ft. logs, is built of 5-in. extruded aluminum I-beams of Alcoa alloy 17S-T. The same alloy is used for the 4-in. extruded I-beams which make up the 45-ft. long runway, and for the 10-in. beams in the husk frame which houses the machinery. F. W. Taylor, general manager of the Augusta Iron Works, and Frank S. Dennis, assistant general manager, designed the mill with the assistance of Alcoa engineers. This type of construction was selected for the portable equipment because it combines strength with light weight, and provides a non-warping, weather-resistant frame. Members of the frame are bolted together as shown in the photograph at left. Illustrations, courtesy Alcoa Newsletter.

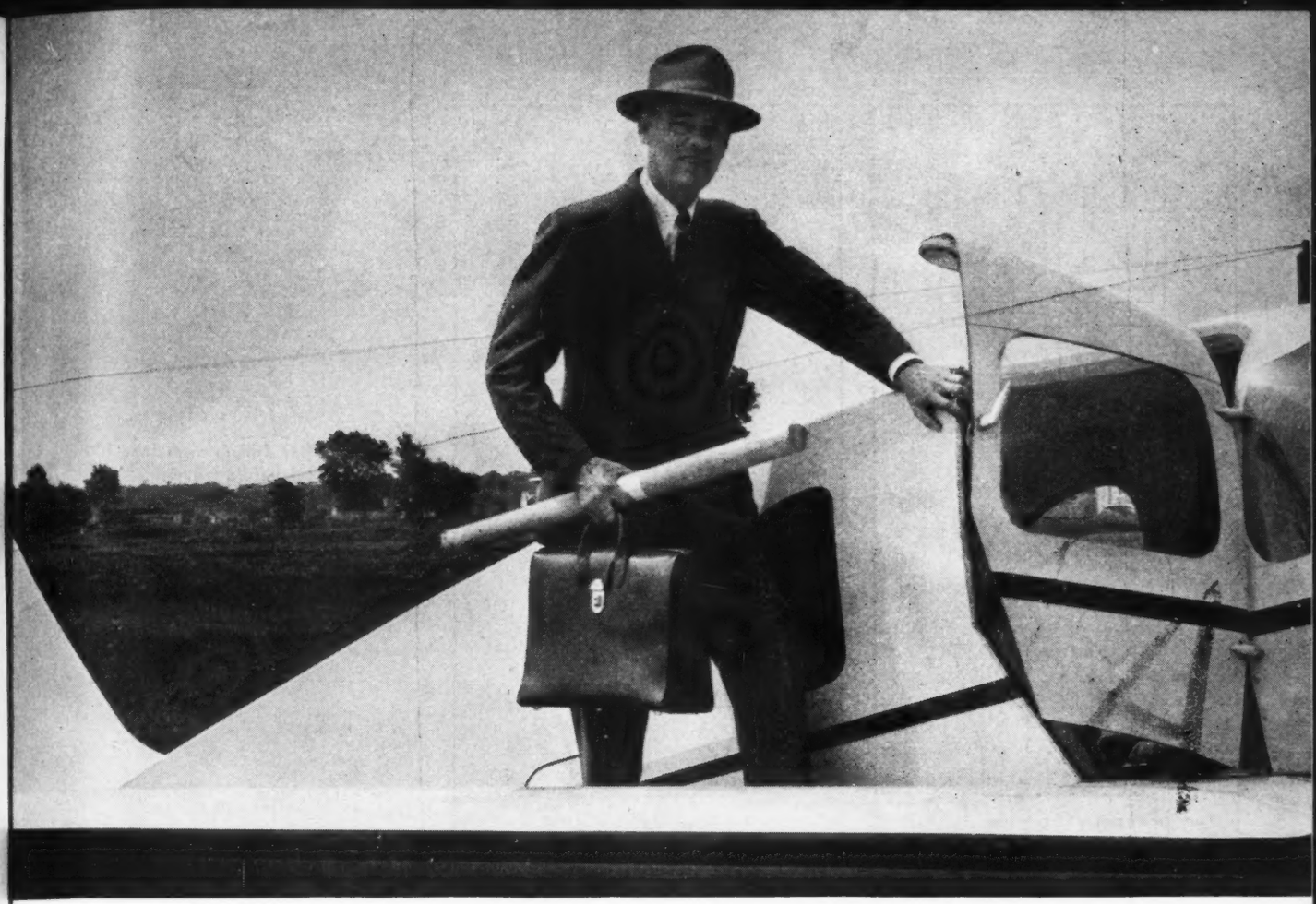
Buzzard-Booster Protects Power Poles





Along about sundown each day, buzzards in the vicinity of the power line from the Barquito power plant to the Potrerillos smelter of Andes Copper Mining Co. in Chile had formed the habit of flying in to roost for the night on the line's steel poles. When they awoke and stretched early next morning, preparatory to a take-off, they often brushed adjoining cables, causing power cut-offs and their own incineration.

J. N. Pyster, at that time resident engineer at Barquito, broke this habit by designing and building the buzzard-booster shown in the accompanying photograph. Installed six to a pole, this inviting perch drops under the incoming buzzard's weight, and the sharp business-end prods the bird either fore or aft, causing him to spend the night elsewhere. The perch is of wood, the rest is of steel.



Manufacturer Flies Ryerson Engineer to Plant . . .

and returns him with problem solved

A machinery manufacturer faced an emergency. He was changing over to flame-cut steel plate for many parts previously cast. In the process of change-over, unforseen production problems threatened to stall his entire operation. Committed to a heavy schedule of deliveries, he saw the threat of reduced volume as an inconvenience to customers—a mark against his company.

Moving swiftly against time, he called Ryerson in a neighboring state, offering to send his company plane if a Ryerson specialist would make a flying trip to his plant. We agreed, and, in a matter of hours, a Ryerson engineer was on the spot giving practical assistance.

By simplifying several parts, engineering difficulties were avoided. Standardization of other parts reduced cost and made better use of available steel. There was no slow-down in production.

As our specialist was flown back that same day, he made out a report covering his activities. It was brief enough. It read: Customer service.

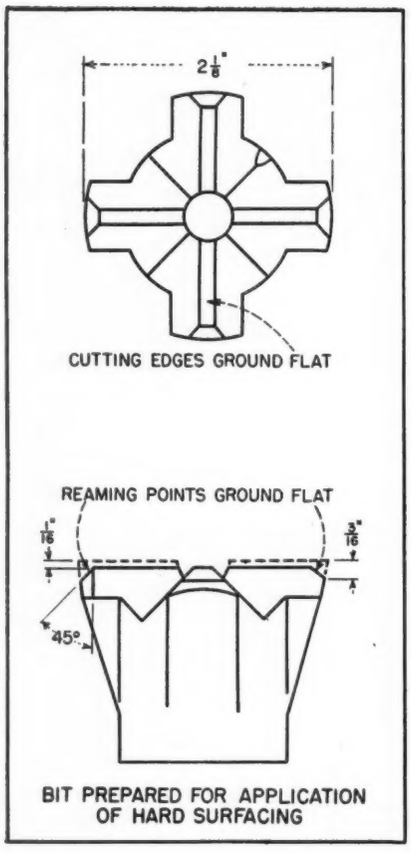
That brief report—customer service—sums up the reason so many steel users make Ryerson the first source for steel from stock and turn to us in time of trouble. Despite steel shortages there is no shortage in our willingness and ability to cooperate. Our technical men will gladly work with you on any steel problem, or assist in the search for a suitable alternate when needed steel is not available.

Remember that Ryerson facilities and experience are always at your service when you call.

JOSEPH T. RYERSON & SON, INC.

Plants: New York, Boston, Philadelphia, Detroit, Cincinnati, Cleveland, Pittsburgh, Buffalo, Chicago, Milwaukee, St. Louis, Los Angeles.

RYERSON STEEL



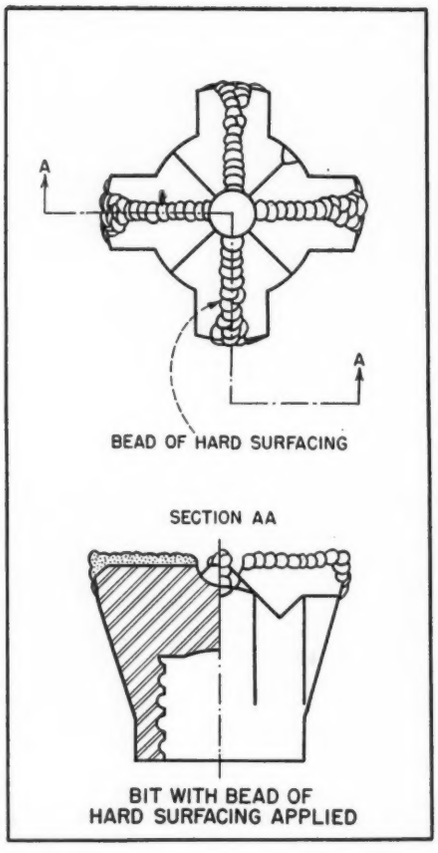


FIG. 1. Bit, after drilling more than 100 ft., but before failure.

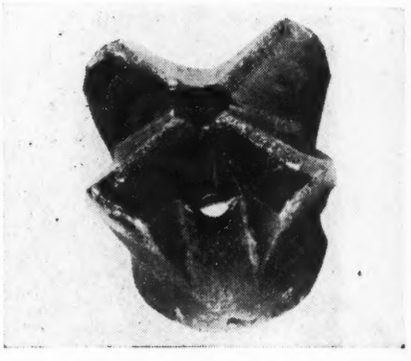
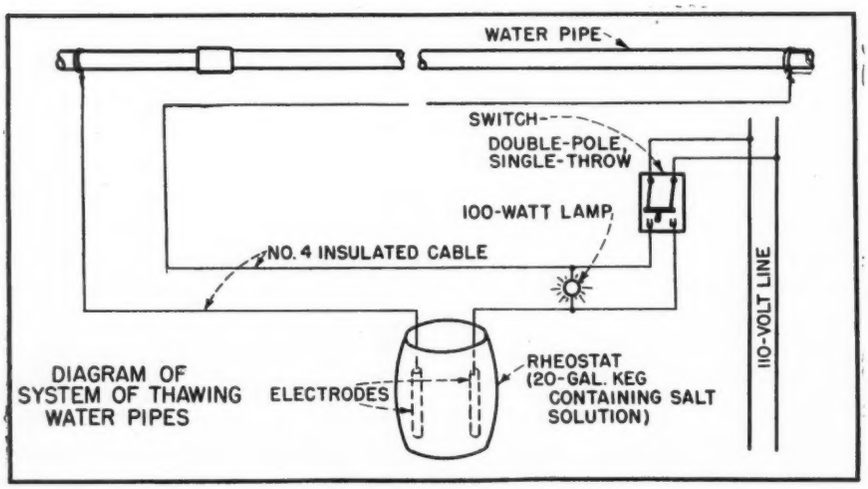


FIG. 2. Bit, after drilling 204 ft. in oil shale.

Hard-Surfaced Bits Used on Oil Shale

The method of preparing hard-surfaced bits for use on the experimental oil-shale project of the U.S. Bureau of Mines, at Rifle, Colo., is shown in the line drawings above. Fig. 1 shows the bit after it had drilled 100 ft. of oil shale, and Fig. 2 shows the bit after it had drilled 204 ft., and began to fail. After drilling 200 ft., the bit still drilled a full-size hole because some of the hard surfacing remained on the gage surfaces. A standard bit loses gage in 3 to 5 ft. of drilling in this shale. Photographs and drawings, furnished through the courtesy of the Bureau of Mines, U. S. Department of Interior.



Improvised Pipe Thawer*

This improvised thawer was used to keep 200 ft. of 2-in. pipe from freezing at the Wilfley mine, Kokomo, Colo., where the U.S. Bureau of Mines operated surface diamond drill equipment. In one instance, the equipment was used to thaw more than 600 ft. of 2-in. pipe, according to Albert D. Zemanek, electrician of the Wilfley Leasing Co., and R. C. Townsend, of the Lakewood Branch of the U.S. Geologic Survey, who submit this article.

Details of the installation are shown clearly here. Either 220- or 440-volt current may be used instead of 110-volt current. The distance between the electrodes determines the amount of heat which will be generated in the pipe. If the electrodes are close, the pipe heats more rapidly, and if too much current is drawn, the solution may boil. A 110-watt bulb installed in parallel as shown will dim if too much current is drawn. Care should be taken that the electrodes do not touch when the current is on. Lead battery connectors make good contacts for this thawing device.

Operations of the Wilfley Leasing Co. at Kokomo were described in an article in *Engineering and Mining Journal*, March, 1946.

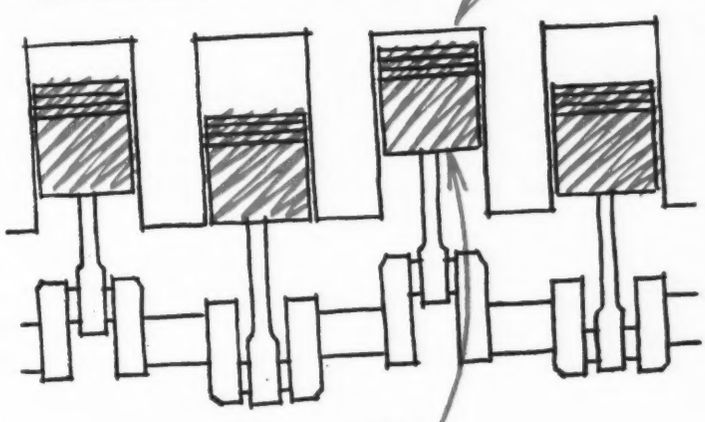
*Published by permission of the Director, U. S. Geological Survey.

LUBE MEMO

Engine overheating caused by stuck rings

Compression loss 30%

400 400 280 400



Hot blowby gases burned piston.

Shop found rings in #2 badly stuck by ordinary oil (blowby has been wasting power).

Foreman claims RPM DELO Diesel Engine Lubricating Oil's compounds will prevent stuck rings 3 ways:

1. Decrease carbon
2. Stop formation of gum.
3. Hold contaminants in suspension (they're flushed out on oil change).

Give shop go ahead on RPM DELO Oil

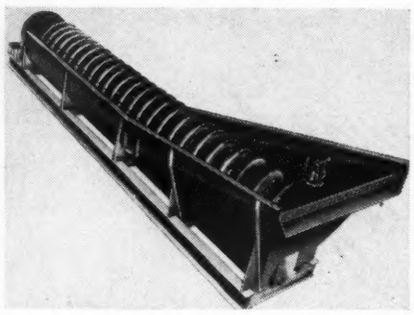
DIESEL ENGINE RPM DELO LUBRICATING OIL

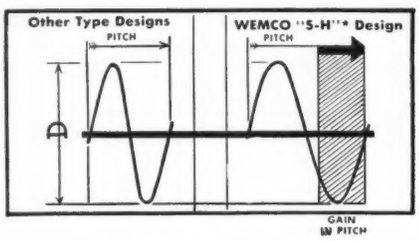
STANDARD OF CALIFORNIA • San Francisco, Calif.
THE CALIFORNIA COMPANY • Denver, Colo.

THE CALIFORNIA OIL COMPANY • New York
STANDARD OF TEXAS • El Paso, Texas

EQUIPMENT NEWS

Higher Raking Capacity for Spiral Classifier





Increased sand-raking capacity is one of several improvements listed by the manufacturer for the new Wemco S-H (Special Helix) classifier, announced recently by Western Machinery Co., San Francisco, Calif. Each size of classifier in the new line is said to be capable of the same job as the next size larger spiral classifier of the former design.

Other improvements include: a new shaft design for greater strength, an economical tank design, a new spiral lifting mechanism, a new drive arrangement, and new main bearings.

Of these, the company regards the special helix as the most significant. As shown in the accompanying sketch, the spiral pitch has been increased in relation to the spiral diameter. This made it possible to add a third ribbon of flights to the central shaft without interfering with the sand-raking capacity of the two original ribbons.

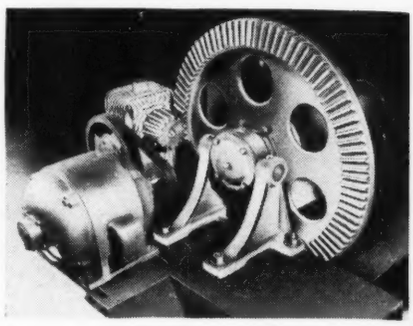
This change, the company states, provides several operating advantages over previous types. It greatly increases the machine's ability to rake sand loads. In some cases, this increase may run as high as 100%, depending on the material and the separation being handled. Also, the special helix allows the machine to do a given job at a lower shaft speed than previous machines. The result is lower power requirement, lowered wear, and less pool agitation.

The manufacturer wishes to emphasize that the special helix does more than merely add a third spiral. Only by a suitable change of pitch has it been possible to add the third ribbon and still keep each ribbon raking at full load. This change in pitch also shortens the length of each ribbon, which makes the flights less expensive. Raking efficiency is said to be increased as a result of the change in pitch, and fewer wearing shoes are needed for the flights. These elements combine, according to the manufacturer, to provide considerable saving in initial investment to the purchaser.

The shaft of the S-H classifier is 40% stronger, a gain resulting from use of large diameter seamless steel tubing. Upper shaft bearings are now housed in a simple, compact gudgeon assembly, and are lubricated for life. The lower, submerged bearing uses two heavy-duty, anti-friction bearings mounted on the spindle. The Wemco coil packing operates under spring tension on a hardened steel sleeve to make the bearing grit-proof.

The tank of the new Wemco machine is built square to avoid the expense of making a rolled steel round bottom. The classifier builds its own bottom out of sand, and the purchaser gets an additional saving in first cost.

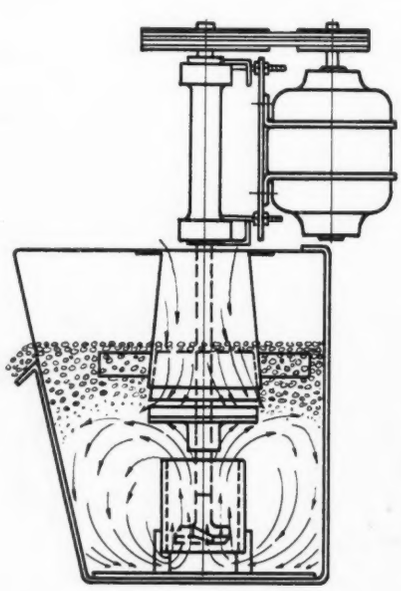
The spiral assembly is now lifted by

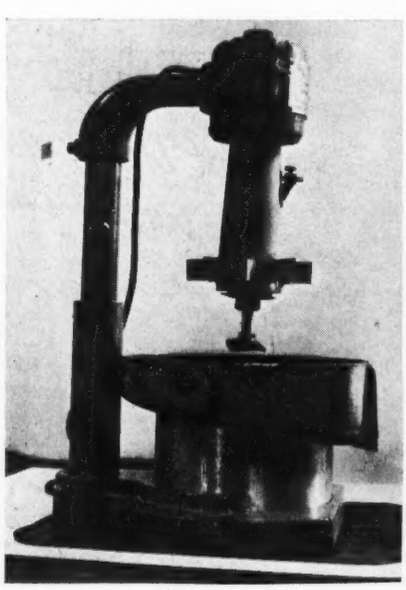


a hydraulic device mounted on a round column set between the lower shaft bearing and the end of the tank. Action is rapid, and can be either hand or motor-operated.

Drive of the classifier has been redesigned to eliminate a gearmotor. As the photograph shows, the drive now consists of a standard-speed motor V-belted to a cone-type gear reducer. This new drive is compact, efficient, and said to be low in cost.

The new S-H classifier is built in a variety of sizes from 16-in. to 78-in. diameter. Several tank lengths are available for each size, in either straight or flared design, depending on requirements. Both simplex and duplex machines are manufactured.





New Design of Flotation Machine

The new Booth flotation machine (U. S. Patent, 2,433,592) is announced by Booth Engineers, 10 West First South St., Salt Lake City 1, Utah. The machine is said to embody new principles in pulp circulation and aeration. The manufacturer states that the machine produces an abundance of fine air bubbles without interference with the pulp circulating function of the machine. Coarse deslimed feed can be treated without banking up of sand.

A rigid, light-weight A-frame construction supports the impeller shaft and motor of the Booth machine. Froth depth is controlled by a new curtain arrangement. Impellers are

you get more work out of Mack Trucks

Built-in durability plus exclusive features of design explain the stand-out performance of Mack super-duty trucks on punishing open pit mining operations. Mack Model LR, specially engineered for this service, is proving to cost-conscious mining men that a Mack on the job means more work done on the job.

because . . we put more work into Macks

Mack trucks for off-highway service take the toughest terrain in stride. Whether it's uneven ground, slippery mud or sand, Mack's exclusive Power Divider assures good going by effectively transferring power to the wheel having the best traction. Two distinct types of the Power Divider are available, one for four-wheel trucks (shown here) and another for six-wheelers.

Mack

trucks for every purpose

Mack Trucks, Inc., Empire State Building, New York 1, New York. Factories at Allentown, Pa.; Plainfield, N. J.; New Brunswick, N. J.; Long Island City, N. Y. Factory branches and dealers in all principal cities for service and parts. In Canada, Mack Trucks of Canada, Ltd.

6219-3

SINCE 1900, AMERICA'S HARDEST-WORKING TRUCK

of pressure-molded all-rubber construction. The accompanying drawing illustrates the cell construction and shows the pulp circulation, and the aeration zones.

The machine is built in multiple units from 20-in. to 54-in. unit sizes.

A laboratory machine is also offered. It is shown in the photograph. Made of stainless steel with rubber impellers, this laboratory cell has a spring-mounted motor and shaft assembly that makes it easy to remove the cell body for discharge of contents and cleaning.

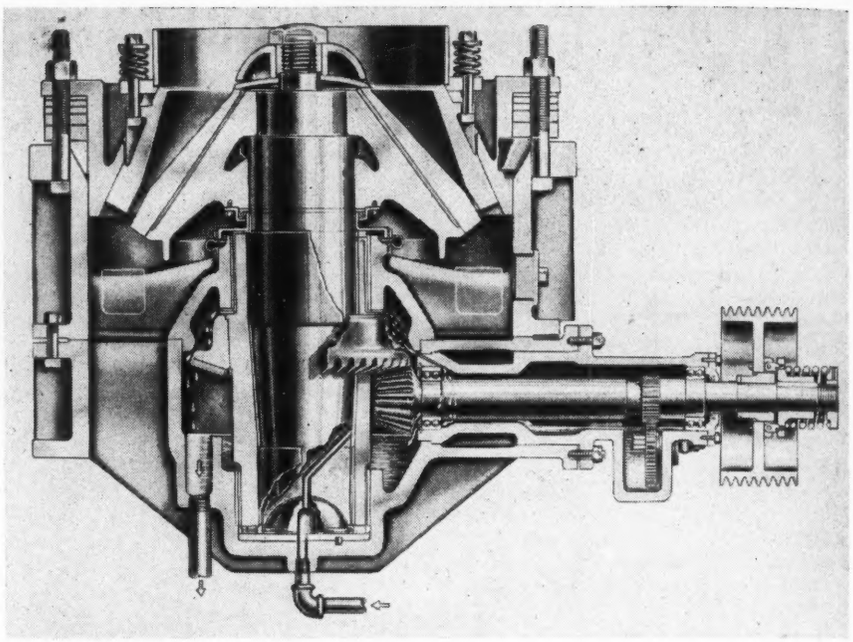
Light-weight Wagon Drill

Designed for use in the mining, building, and construction fields, a new light-weight wagon drill has been developed by the Ingersoll-Rand Co. Known as the Wagonjack, the machine is said to combine the drilling stability of a wagon drill with the portability of the jackhammer.

The Wagonjack takes either the J-50 Jackhamer or the DA-30 drifter. It features a chain feed driven by an air motor. A self-locking worm gear keeps the drill from jumping forward when a soft spot is struck. Control handles for both the drill and the air motor are grouped on the air motor mounting, which may be raised or lowered on the tower to suit the operator.

The adjustable mounting permits extreme flexibility in setting up the drill on uneven terrain. Holes can be drilled at any angle from horizontal to vertical. The entire tower can be removed and used on a bar or column. Adjustable anchor legs prevent creeping while drilling. By reason of its greater drilling speed and elimination of operator fatigue, the Wagonjack is said to be able to drill more feet of hole per cu. ft. of air consumed than a hand-held drill can.

For full details on the Wagonjack, write Ingersoll-Rand Co., 11 Broadway, New York 4, N. Y., requesting Form 4070.



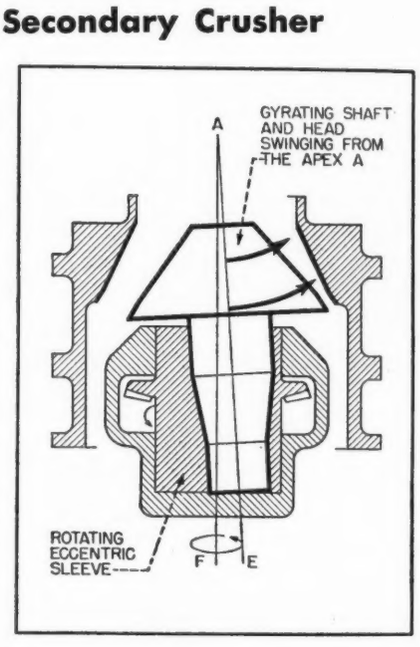
Economical and Efficient Secondary Crusher

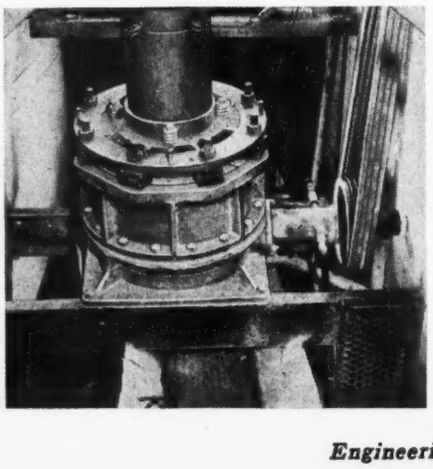
Designed for the secondary and fine crushing field, a new Kue-Ken Gyracone crusher was announced recently by Straub Manufacturing Co., 472 Chestnut St., Oakland 7, Calif. The Kue-Ken principle of "crushing without rubbing" has been applied to this circular crusher through its extra-large shaft and its gyratory motion.

Other features of the new crusher include: low headroom requirement; low wear on crushing faces; easy adjustment; low power consumption; effective lubrication; automatic protection against lubrication failure; protection against tramp iron; high crushing capacity.

The Gyracone comes in two sizes, 18-in. and 36-in. Details are given in the accompanying sectional photograph and the sketch. The mechanism is concentrated in the sealed central housing just under the crushing head. The main shaft is a long steel forging of abnormal size, machined and polished to a precision fit. Its diameter in the 18-in. crusher is 7 in., and in the 36-in. unit, it is 12 in.

Large bronze bearings, at both upper and lower ends of the central housing, carry the shaft and the eccentric sleeve in which it is mounted. The upper bearings are close under the crushing head, which reduces overhang and puts the load squarely on the bearings. The lower end of the shaft is formed to take a semi-spherical bronze step-bearing, which glides easily on the hardened and polished thrust plate in the very bottom of the housing.





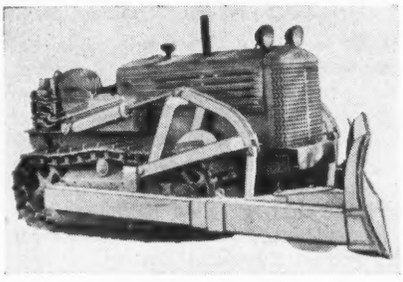
Weight and thrust of the eccentric sleeve are taken by bronze washers. The driving gear is keyed to the outside of the sleeve between the bearings. The sleeve is bored at an angle to give the "apex of gyration" that is a part of the Kue-Ken crushing principle developed by the manufacturer. This is angle FAE in the sketch. The arrows indicate the path of the crushing surface, which, the manufacturer states, provides direct crushing action

without the rubbing action that abrades plates wastefully.

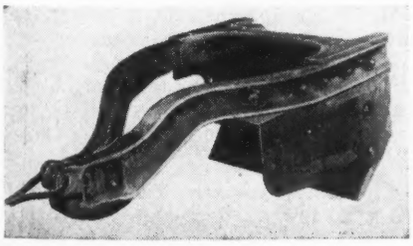
The Gyracone lubrication system includes an oil pump driven from the crusher shaft, a storage tank, a filter, a pressure control valve, a pressure switch and gage, and a complete pipe assembly. The pump circulates several hundred gallons per hour of filtered oil through the operating mechanism. The crusher will not operate unless the lubrication system is working properly.

Size of product is easily adjusted by varying the number of spacer blocks placed under the top flange. A simple overload release at the end of the drive pulley protects the crusher against overload and tramp iron. It can be set for any desired load by adjusting the ring nut at the end of the shaft.

Height of the 18-in. Gyracone from foundation to top is only 30¼ in.; height of the 36-in. unit is 45 in. Power required varies between 15 and 30 hp. for the 18-in. crusher, and between 30 and 60 hp. for the larger model. The crushers run at 985 to 1,164 rpm. The frames are of cast steel.



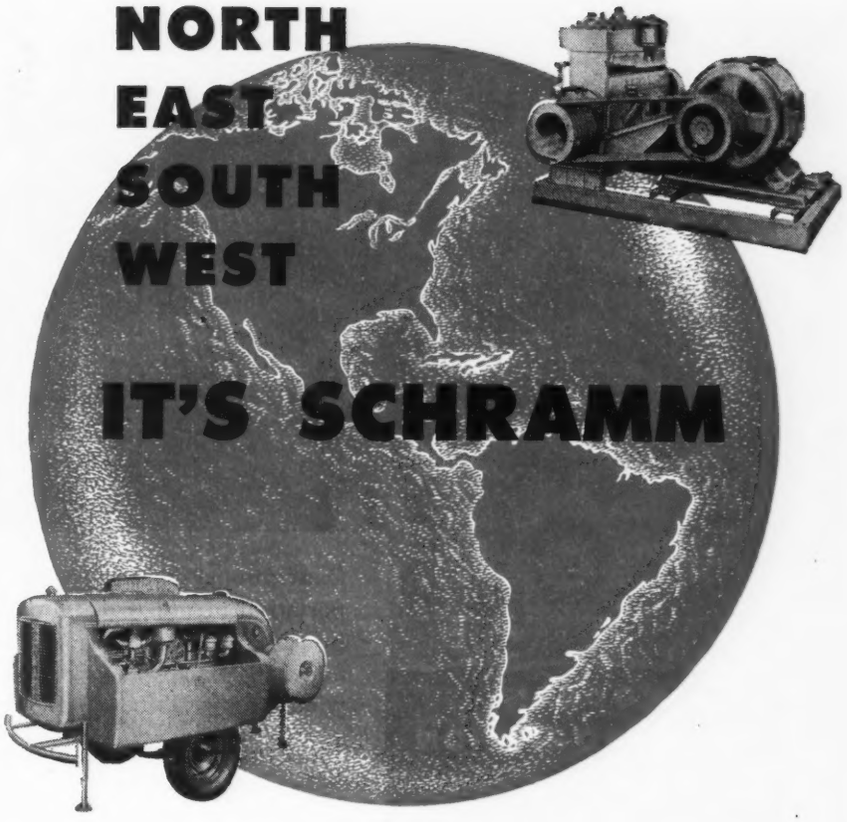
TWIN HYDRAULIC CYLINDERS make this Drott bulldozer blade easy to tilt as the operator wishes. Drott bulldozers and shovels are now sold and serviced by the Oliver Cletrac organization. For details, write Drott Mfg. Co., Milwaukee 12, Wis.



High-Capacity Scraper

New design for moving greater tonnages is reported for the new Amsco-Whisler scraper, recently announced by American Manganese Steel Division of American Brake Shoe Co., Chicago Heights, Ill. One-piece rigidity is given the scraper by means of dovetailed castings that interlock and bind the whole assembly into a solid unit. There is no stress on the assembly bolts, which are recessed for protection against impact.

The scraper is designed to get out large tonnages through the attach-



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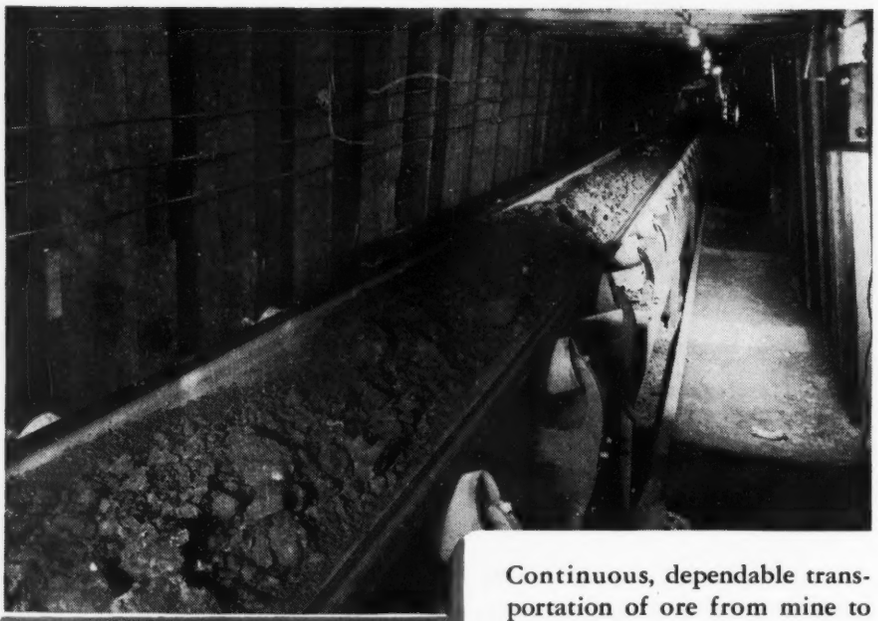


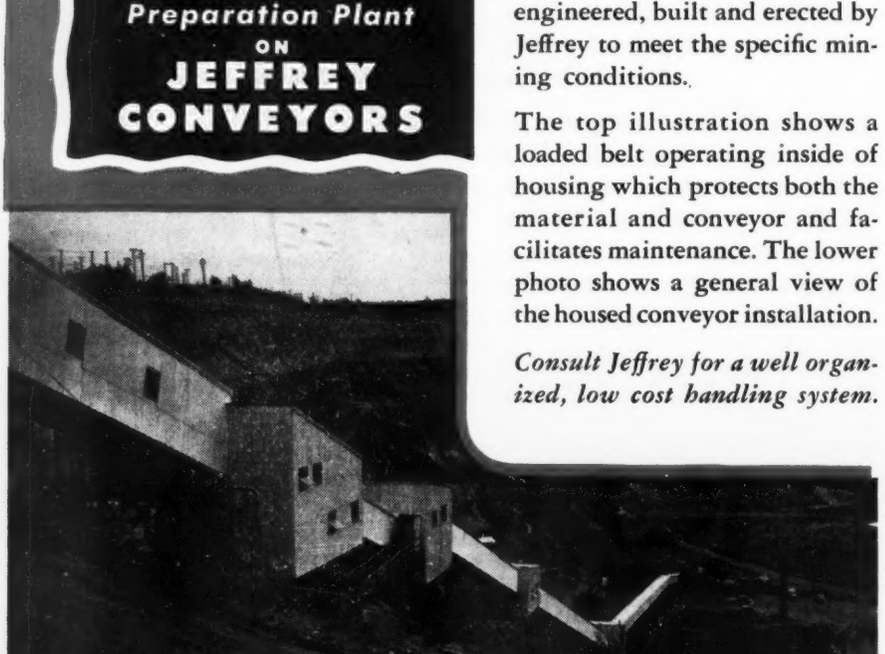
MODERN TRANSPORTATION
From Mine to Preparation Plant
ON
JEFFREY CONVEYORS

Continuous, dependable transportation of ore from mine to preparation plant is most economically handled at this mine with Jeffrey Belt Conveyors.

This installation like most Jeffrey equipped operations was engineered, built and erected by Jeffrey to meet the specific mining conditions.

The top illustration shows a loaded belt operating inside of housing which protects both the material and conveyor and facilitates maintenance. The lower photo shows a general view of the housed conveyor installation.

Consult Jeffrey for a well organized, low cost handling system.



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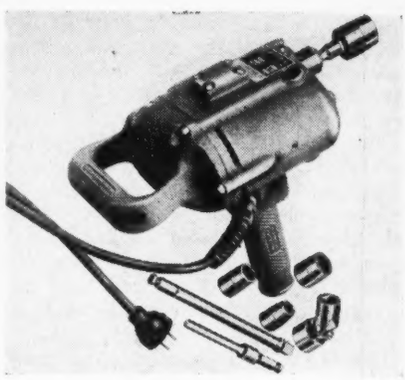
Buffalo 2	Denver 2	Huntington 19	Philadelphia 3	Salt Lake City 1

ment of arms to body ends for wider spacing. For maximum life, the unit is austenitic manganese steel throughout. The new scraper comes in eight widths between 30-in. and 72-in. in size.



IMPACT NUT SETTER, powered by electricity, is announced by Illinois Gage & Mfg. Corporation, 4639 W. Washington Blvd., Chicago 44, Ill. It will take up to ¾-in. bolts and nuts, and is said to be fast, easy on the operator, lightweight, and serviceable.

INDUSTRIAL NOTES

Ohio Brass Co., Mansfield, Ohio, announces two changes in its district sales organization. **T. J. Harris** is being transferred from the Kentucky-Tennessee district to the Chicago office, where he will take over the territory formerly handled by the late **Carl Burkhalter. Paul E. Wright** has been appointed district manager for Mr. Harris' former territory.

A new division, **Robins Engineers**, has been organized by **Hewitt-Robins, Inc.**, to handle the constructing phases in the design, engineering, and installation of complete material handling and processing plants.

Worthington Pump & Machinery Corporation, Harrison, N. J., announces the appointment of **Henry H. Ritchette** as regional manager in charge of sales of Worthington construction and mining equipment in Canada. His headquarters will be in Toronto at the offices of John Inglis Co., Ltd.

Chicago Pneumatic Tool Co., will build a new factory this spring in Utica, N. Y. Containing over a half-million feet of floor space, the plant will be one of the most modern industrial buildings in the East.

BULLETINS

Centrifugal Pumps. Bulletin 47-8020, published by Byron Jackson Co., Pump Division, Los Angeles 54, Calif., describes the Hydroplex pump, a split-case multi-stage centrifugal pump for low capacity, high pressure pumping. Head range is from 450 to 1,700 ft.

Floor Repairs. A folder describing Stonhard resurfacer, a heavy-duty material for repairing or covering wood or concrete floors, is ready for distribution from Stonhard Company, 401 North Broad St., Philadelphia 8, Pa.

Welding Connectors. A two-page bulletin entitled "Causes and Cures for

Hot-Running Welding Cables and Connectors" has just been issued by Tweco Products Co., Wichita 1, Kas.

Borrowing on Inventory. Inventory financing, a method of using inventory as collateral for working capital loans, is discussed in a booklet published by Lawrence Warehouse Co., 37 Drumm St., San Francisco 11, Calif.

Handy Cylinders. Complete design, installation, and operating data for both air and hydraulic cylinders are contained in new bulletins of Miller Motor Co., 4027 N. Kedzie Ave., Chicago 18, Ill.

Metals and Alloys. A new edition of a booklet listing specifications and typical analyses of metals, alloys, and carbides is now available from Murex, Ltd., Rainham, Essex, England.

Gears. All the Falk precision products, such as gears, speed reducers, couplings, and special drives, are described in a new bulletin, No. 10,000, available from the Falk Corporation, 3001 West Canal St., Milwaukee 8, Wis.

Rotary Kilns. Rotary kilns for lime, cement, and chemical plants are described in a new 32-page bulletin issued recently by Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.

Belt Conveyors. The complete line of Jeffrey belt conveying equipment is described in catalog 785, including data on trippers, idlers, pulleys, bearings, and feeders, available from Jeffrey Manufacturing Co., Columbus 16, Ohio.

Vibrating Equipment. Syntron Company, Homer City, Pa., has prepared a new 92-page catalog describing, first, the company's complete line of vibrating feeders, grizzlies, and other machines, and second, the company's line of construction and maintenance tools. For a copy, address L. R. Morgan at Syntron on your company letterhead.

Lock Nuts. Flexloc lock nuts, and the reasons for their high performance, are described in a new bulletin of Standard Pressed Steel Co., Jenkintown, Pa.

Fire Hose. A new catalog section on its line of industrial fire hose for mill and plant protection has been published by B. F. Goodrich Co., Akron, Ohio.

Self-Priming Pump. Allis-Chalmers' automatic, self-priming pump equipped with a new type automatic spring valve, which is said to give faster, smoother transition from priming to straight centrifugal action, is described in a new 8-page bulletin, No. 08B6319B, sent on request to Allis-Chalmers Mfg. Co., Milwaukee 1, Wis.

Pumping Concrete. Grout can be pumped through pipe lines with air pressure and a device offered by Prehy Co., Graybar Bldg., New York 17, N. Y. The method is described in a new booklet just issued by the company.

Wide Belt Cutter. An easy way to cut wide belts accurately is described in bulletin No. BC-350, recently issued by Flexible Steel Lacing Co., 4607 Lexington St., Chicago 44, Ill.

Big Tractor. A six-page folder describing Allis-Chalmers' new HD-19 163-hp. tractor (said to be the most powerful made) can be had by writing to Allis-Chalmers Mfg. Co., Milwaukee 1, Wis., asking for bulletin MS-608.

Blowers. Centrifugal blowers and exhausters are described in a new 12-page booklet recently issued by United States Hoffman Machinery Corporation, 105 Fourth Ave., New York 3, N. Y.

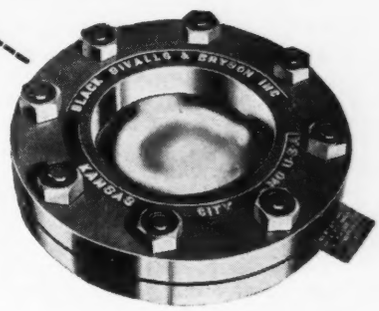
Flat Motor. The axial air-gap motor, also called the "pancake" motor, made by Fairbanks, Morse & Co., 600 South Michigan Ave., Chicago 5, Ill., forms the subject of a new bulletin completely describing its design and characteristics.

Drying and Cooling. Catalog 804 of Jeffrey Manufacturing Co., Columbus 16, Ohio, describes the complete line of Jeffrey-Traylor processing equipment, largely for drying and cooling.

Open Pit Mining. A new 8-page color booklet of Caterpillar Tractor Co., Peoria, Ill., discusses the subject of "open pit mine and quarry operation with Caterpillar diesels."

Magnetic Pulleys. A bulletin describing the new Perma-Pulley, a magnetic pulley made with permanently-magnetic Alnico alloy, has been issued by Dings Magnetic Separator Co., 4740 W. McGeogh Ave., Milwaukee 14, Wis.

Stud Book



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PERSONAL NEWS

Worthen Bradley, president of the Bradley Mining Co., San Francisco, was elected chairman of the Western Division of the American Mining Congress for 1948. He will take a leading part in arranging for the Metal Mining Convention and Exposition to be held at San Francisco in September.

E. S. McGlone, vice president and general manager of western operations of Anaconda Copper Mining Co., Butte, Mont., is chairman of the program committee for the above convention. **J. J. Huether,** General Electric Co., Schenectady, N. Y., assumed the chairmanship of the Mining Congress' Manufacturers Division, which will sponsor an exposition of mining machinery and equipment in conjunction with the Metal Mining Convention.

W. H. Holmes, assistant superintendent of the San Pedro unit of the American Smelting and Refining Co. at San Luis Potosi, S.L.P., Mexico, has been transferred to the company's Selby plant in California. Mr. Holmes was connected with American Smelting in Mexico for 33 years.

George C. Zeller has been appointed assistant director of public relations, Oliver Iron Mining Co., Duluth, it was announced by **Joseph H. Jordan,** head of public relations for this U. S. Steel subsidiary.

K. S. Herness, instructor in economic geology at the Montana School of Mines, terminated his duties there Jan. 31 to study for his doctorate in geology at the University of Minnesota, where he received his E.M. (Geology) degree in 1937.

John E. Bowenkamp, examining engineer for Wellington Exploration, Ltd., subsidiary of N. A. Timmins Corporation, of Montreal, is back in the field after a vacation of several months in the States. At present he is on an assignment at Frontino Gold Mines, Ltd., Segovia, Colombia.

Richard J. Anderson, economic geologist, has been appointed to the staff of Battelle Memorial Institute, Columbus, Ohio, where he will be engaged in studies on the economics of raw materials. Mr. Anderson was formerly a geologist for Alcoa Mining Co., New York, and more recently managing engineer with Raw Materials Survey, Inc., Portland, Ore.

A. O. Bartell is now managing engineer for Raw Materials Survey, Inc., Portland, Ore., replacing **Richard J. Anderson.**

Louis J. Erck, formerly with Butler Brothers, Cooley, Minn., has been appointed chief metallurgist for Cleveland-Cliffs Iron Co., at Hibbing, Minn.

WALTER E. REMMERS

William J. Priestley has been elected a director of Union Carbide and Carbon Corporation, it was announced by **Fred H. Haggerson,** president. Mr. Priestley, also chairman of the board of Electro Metallurgical Co., a unit of the above corporation, has announced the election of **Walter E. Remmers** as president of this company, of the Electro Metallurgical Company of Canada, Ltd., and of other associated metallurgical units of Union Carbon and Carbide. Mr. Remmers has been vice president and a director of Electro Metallurgical Co. since 1945.

The resignation of **C. P. Browning,** for more than 25 years general manager of Britannia Mining and Smelting Co., Ltd., at Britannia Beach, B. C., terminates an association of 35 years with the Canadian mining industry. Mr. Browning is succeeded by **E. C. Roper,** who has been employed by Britannia in various operating and executive capacities, and recently as assistant general manager.

C. P. BROWNING

S. H. Dolbear, who has been doing professional work in Southern California, came East recently to attend conferences in New York and Washington. He has now returned to the West Coast.

R. W. Richardson has joined Calumet & Hecla Cons. Copper Co., Calumet, Mich., as commercial research engineer, a newly created position.

E. P. Scallon, St. Paul, Minn., was elected chairman of the Minnesota Section, A.I.M.E., at the section's business meeting Jan. 12. Mr. Scallon succeeds **R. W. Whitney. Charles J. O'Connell** was elected secretary-treasurer to succeed **W. L. Taylor,** who becomes vice chairman.

Frank W. McQuiston, Jr., was recently appointed consulting metallurgist for the raw materials division of the Atomic Energy Commission. He will maintain headquarters in Washington, D. C. Mr. McQuiston has been with Newmont Mining Corporation for several years, and is also consulting metallurgist for Getchell Mine in Nevada.

Walter H. Aldridge, president of Texas Gulf Sulphur Co., has announced the resignation, due to ill health, of **Henry F. J. Knobloch** as secretary and treasurer. **Richard T. Fleming** succeeds Mr. Knobloch as secretary and general counsel, and **Edward C. Meagher** has been made treasurer. Mr. Aldridge also announced the appointment of **William Attwood** as controller and assistant treasurer of the company.

Allan M. Short, formerly mineral technologist for Missouri Pacific Lines, has announced that he is engaging in private practice as geologist and mineral technologist specializing in industrial raw materials, at 817 Arcade Building, St. Louis.

Charles B. E. Douglas, consulting engineer for United States Smelting, Refining and Mining Co., has been transferred from the Boston headquarters to the Salt Lake City office.

Joseph B. Perry of Westvaco Chlorine Products Corporation, formerly mines manager for magnesite, barite, dolomite and other non-metallic mineral production, has been appointed mines development manager, in which capacity he will have charge of mineral exploration activities, mine property development and beneficiation methods for all Westvaco mining operations in California, Nevada, Wyoming and Idaho. He will continue to maintain headquarters at Westvaco's Newark, Calif., plant.

Russell Benton Kulp has been appointed superintendent of construction for the Tennessee Coal, Iron and Railroad Co., Birmingham, Ala. He succeeds **M. P. Mellon,** retiring superintendent. **Joseph J. McElliott** was named assistant superintendent, replacing **C. C. Kelley,** also retiring.

... H. Lange, metallurgist, who has been recently promoted to the position of vice-president of the Galigher Co., of Salt Lake City, Utah, left for South Africa at the end of January to aid in promoting the interests of B.M.S., Ltd., of Johannesburg, manufacturing and sales agent for the Galigher Co. Mr. Lange will also act in a consulting capacity in the opening of a new lead-zinc-copper milling operation in Southwest Africa.

Dr. M. D. Garretty, formerly consulting geologist to North Broken Hill, Ltd., New South Wales, has rejoined the company as chief geologist and will direct exploratory work in the search for new ore deposits.

From Johannesburg comes word that **John Martin,** well-known administrator in South African gold mining, has retired because of ill health. At the time of his retirement Mr. Martin was managing director of Central Mining and Investment Corporation and chairman of Rand Mines, Ltd., and Crown Mines, Ltd., having previously been manager of Corner House, headquarters of the Central-Rand mines group. He had also served in past years as president of the Transvaal Chamber of Mines and director of the Bank of England.

W. W. Ramseur, Gulf Refining Co., Laurel, was elected chairman of the Mississippi subsection of the American Institute of Mining and Metallurgical Engineers at a meeting at Brookhaven, Miss. **R. E. France,** of the California Co., Natchez, was named first vice-chairman; **H. B. Leeton,** Gulf Refinish Co., Laurel, second vice-chairman; and **F. G. Prutzman,** Sun Oil Co., Jackson, secretary-treasurer.

D. P. C. Neave, managing director of the Imperial Smelting Corporation, left England for Australia Feb. 3 to arrange details for the construction of new plants to produce sulphuric acid, fertilizer, chemicals and the fabrication of zinc. Mr. Neave's trip is in connection with the policy of his company and that of The Zinc Corporation, Ltd., and New Broken Hill Consolidated, Ltd., for joint action in the development of industries in Australia.

Recently elected vice presidents of International Nickel Co. of Canada, Ltd., are **Ralph D. Parker** and **J. Roy Gordon,** Copper Cliff, Ont., and **Herbert G. Fales,** New York. **Walter C. Kerrigan, James F. McNamara** and **T. H. Wickenden** were elected vice presidents of International Nickel Co., Inc., in New York.

James Gilbert Miller, until recently superintendent of engineering at Westvaco Chlorine Products Corporation's plant in South Charleston, W. Va., has been designated as resident manager of the new elemental phosphorus plant being constructed by Westvaco at Pocatello, Idaho.

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Edwin O. Botten of Cripple Creek, geologist and mineralogist, has been appointed engineer in charge of mining operations for Mineral Processors, Inc., New York, operating the Trail tunnel under lease from the United Gold Mines Co. and the Dexter mine under lease from the Hamlet-Dexter Corporation.

G. F. V. Anderson, until recently assistant mine superintendent at Mt. Isa Mines, Ltd., North Queensland, is now with Big Bell Mines, Ltd., Big Bell, Western Australia.

Charles P. Robbins, who recently resigned after many years as treasurer of the Northwest Mining Association of Spokane, Wash., was presented with the "legion of honor" award by the American Institute of Mining and Metallurgical Engineers. This award is given to engineers who have been members of the Institute for 50 years, and only 128 engineers in the U. S. have been honored thus.

ERRATUM:

F. X. Tartaron, author of the article on Iron Ore Beneficiation, Feb. issue of E&MJ, writes that the statement appearing on page 112, top of first column, is in error. Oglebay-Norton is completing plans for the construction of a 77-million-dollar plant, and not "completing construction," as previously stated.

Donald D. Harries has been appointed assistant general solicitor for the local subsidiaries of the U. S. Steel Corporation operating in the Duluth area.

The Division of the Geological Sciences, California Institute of Technology, has appointed **Dr. R. Dana Russell** as visiting professor in sedimentary petrology, and **Dr. C. Hewitt Dix** as associate professor, specializing in the seismic and gravitational phases of applied geophysics. Dr. Russell is consulting geophysicist for the U. S. Navy Electronics Laboratory; he made many contributions to the sedimentary petrology field while on the staff of Louisiana State University and as a member of the Sub-Committee on Sedimentation of the National Research Council. Dr. Dix has been a geophysicist with the United Geophysical Co. for the past six years.

J. C. Johnson, formerly deputy director of the Office of Metals Reserve, Reconstruction Finance Corporation, is now assistant director of the division of raw materials of the Atomic Energy Commission, Washington 25, D. C.

M. Subramanyam returned to India in February after completing his studies for a Master's degree in mining geology at the Missouri School of Mines at Rolla.

Lloyd J. Severson has been appointed assistant to general mining engineer by the Oliver Iron Mining Co., Duluth, Minn. Graduating in 1936 from the University of Wisconsin, where he majored in geology, Mr. Severson spent the following five years in mining and exploration work for two South American mining companies in Bolivia. In 1941, he became a mining engineer for the U. S. Steel mining subsidiary at Hibbing. During the war he served as principal mining engineer for the Foreign Economic Administration in Bolivia and Spain. He has since occupied the position of geologist in the Oliver general offices at Duluth. **Forbes B. Cronk** is general mining engineer for the company and **J. F. Wolff** assistant general mining engineer.

Albert T. Koenen has been appointed superintendent of Oliver Iron Mining Co.'s Trout Lake Concentrator at Coleraine. **E. A. Friedman** is general superintednet of Oliver properties in the Coleraine district. Mr. Koenen, with the company's research laboratory since April, 1947, succeeds **W. L. Kendrick**, who resigned to accept a mining position in Daingerfield, Texas.

W. H. Prescott, Jr., has been admitted to the firm of Pickands, Mather & Co., Cleveland, Ohio, as a partner after 25 years of service with the company. For the past five years he has been manager of the iron ore sales department. Admitted to partnerships at the same time are **J. R. Chandler**, manager of the firm's coal department and **S. S. Robinson**, manager of its Chicago office. The other partners are: Elton Hoyt II, senior partner; John Sherwin, Herbert C. Jackson, George W. Streibing, all of Cleveland; and Alex D. Chisholm, of Duluth.

James L. Bruce has resigned as general manager of Cyprus Mines Corp. after 22 years of service with that firm. Prior to that time, Mr. Bruce had been manager of the Butte & Superior Mining Co. and manager of the Davis-Daly Copper Co. in Butte.

Heath Steele, vice president of the American Metal Co., sailed on the Queen Mary on Jan. 17 for London. Before returning to the States he will visit Northern Rhodesia to inspect the Roan Antelope and the Mufulira mines and will visit the Tsumeb and O'okiep mines in Southwest Africa.

During his 40 years' association with mining in the Belgian Congo, **Sydney H. Ball** of the firm of Rogers, Mayer and Ball, New York, has been decorated three times by the Colonial Government for furthering the development of mining in that colony—first as Chevalier de l'Ordre Royal du Lion, later as Officer de l'Ordre Royal du Lion, and in January, 1948, as Commandeur de l'Ordre de Leopold II.

Dr. H. Foster Bain, who has been engaged in professional work in Japan and the Philippine Islands during December and January, returned to New York by plane for a few weeks and left again for the Orient on February 5. His present plans will require his presence in Manila until April or May; he can be reached at the Manila Hotel.

Arthur S. Hecht, consulting mining engineer of San Francisco, has been appointed consulting engineer for the Department of Commerce military government in Korea. He may be addressed Headquarters USAMGIK, Department of Commerce, APO 235, Unit 2, c/o Postmaster, San Francisco, Calif.

William A. Irvin, former president of U. S. Steel, and now a director and member of the finance committee of the corporation, has been presented with the Ribbon of the King's Medal for Service in the Cause of Freedom, by Sir Francis E. Evans, the British Consul-General. In 1941 Mr. Irvin was chairman of the Iron and Steel Division of The British War Relief Society.

Warren Jamar, mechanical engineer of Duluth, has accepted a position with M. A. Hanna Co., Iron River, Mich.

Harry S. Peterson, general superintendent for Jones & Laughlin Ore Co. in Michigan, has been elected president of the Marquette Range Engineers' Club.

R. H. Ely is president of the Engineers' Club of Northern Minnesota for 1948. **Sander G. Lawrence** is vice president; and **E. A. Friedman**, secretary-treasurer. The directors are: **P. W. Kruse, J. H. Harrison, Earl S. Mollard, A. J. LeMire, John Chisholm** and **Kenneth Duncan.**

C. E. McManus, formerly superintendent of M. A. Hanna Company's Clifton mine at DeGrasse, N. Y., has transferred to the Mesabi iron range in the capacity of district superintendent, with headquarters at Hibbing, Minn.

Robert Edwards, formerly engineer at Inland Steel Co.'s Greenwood mine at Ishpeming, Mich., has been transferred to the Armour mine at Crosby, Minn. **Blair Burwell** becomes engineer at the Greenwood.

A. D. Chisholm, general manager of Pickands, Mather & Co., Duluth, and Mrs. Chisholm are visiting South America, their itinerary including Chile, Argentina and Brazil.

Joseph A. Fowler is now with Oliver Iron Mining Co. as a mining engineer in the Hibbing-Chisholm district.

John R. Howes has joined the mining engineering staff of the M. A. Hanna Co., Hibbing, Minn.

OBITUARIES

REGINALD K. NEILL

Reginald K. Neill, 85, a veteran in mining development in the Pacific Northwest, died in Spokane, Wash., Jan. 25, of a heart attack. His development work at the Premier gold mine near Stewart, B. C., where he spent $4,000, led the way to more than three million dollars worth of gold ore in two and one-half years. Important early mills at Bunker Hill & Sullivan, Tamarack, Custer, and Morning mines were built by Mr. Neill. At the time of his death he was president of the Saranac Mining Co. and had interests in mines in British Columbia.

J. R. Henderson, retired purchasing agent for U. S. Smelting, Refining and Mining Co., died Jan. 5 at his home in Alameda, Calif.

Alex J. McGregor, for many years manager of the Liberty Montana Mines Co. at Mammoth, Mont., died suddenly at his home there on Jan. 17.

Winthrop Hosmer Wright, 78, died in Helena, Mont., on Jan. 27. Mr. Wright was for a long time U. S. assayer at the government assay office which was at that time located in Helena.

John Schweiger, of Chisholm, for more than 35 years fee-owner representative for the McCahill interests at the Shanango mine on the Mesabi Range, died Jan. 25, aged 78.

Thomas P. Evans, ore clerk for M. A. Hanna Co., died at Hibbing, Minn., Jan. 27.

Patrick J. Nolan, who retired in 1939 after long service with Oliver Iron Mining Co., died Jan. 25 at Gilbert, Minn., aged 78. He was the father of Ray D. Nolan, director of the Minnesota Division of Lands and Minerals at St. Paul and District Judge Mark E. Nolan.

Harry L. Frevert, director of the Midvale Co., Philadelphia, died December 11 after a short illness. Mr. Frevert, who received his Ph.D. in metallurgy at Harvard, was president of the company from 1931 to 1944.

REGIONAL NEWS

Dedicating a monument on the site of Sutter's mill, at Coloma, Calif., where James Marshall discovered gold Jan. 24, 1948. Governor Earl Warren (microphone in hand) addresses the gathering. Associated Press Photo.

CALIFORNIA

Largest mineral output on record in 1947—Argonaut Mining Co. dissolved—Eagle-Shawmut shuts down

★Total value of mineral production in California for 1947, as estimated by the Economic Section, is $744,731,000, according to a press release by Olaf P. Jenkins, chief, State Division of Mines, Ferry Building, San Francisco. The estimated total is an increase of about $185,282,000 over the total of $559,449,469 in 1946. It is the largest mineral output on record. This was the result of an unsurpassed output of petroleum with the highest average price per barrel ever recorded. Increases were noted also in the output and value of gold, silver, cement, salines, and miscellaneous.

Estimated quantities of metals produced during 1947 are as follows: Gold, 410,740 oz.; silver, 1,644,000 oz.; copper, 4,760,000 lb.; lead, 20,380,000 lb.; zinc, 10,600,000 lb.; quicksilver, 15,000 flasks. The value of other metals, including chromite, iron ore, molybdenum, tungsten, and platinum-group metals, amounted to about $3,750,000. Estimated value of miscellaneous industrial non-metallic minerals is $15,175,000, and that of salines (borates, iodine, potash, salt, soda, etc.) is $22,500,000.

★Dissolution of Argonaut Mining Co. was recommended by its board of directors at a meeting held in San Francisco in late December. First incorporated in 1893, the company's principal property is the Argonaut gold mine at Jackson, Amador County, one of the oldest on the Mother Lode. The company also owns the Plymouth gold property at Plymouth, Amador County. The Argonaut mine has been inactive since 1942 and tailings operations at the Plymouth property were suspended in 1943. Decision to dissolve the company was reached because of impossibility of resuming mining in the foreseeable future, owing to general conditions and the present price of gold.

★W. P. Bean Clipper Mills, Clyde Stone, and Robert Salvi, are developing a promising gold-quartz vein discovered in 1947, one-half mile east of Woodleaf, Yuba County. Work done includes stripping the hanging wall to a depth of 30 ft. for 100 ft. along the vein by tractor and bulldozer, and sinking a prospect shaft to 60 ft. A quantity of mined ore was treated in a small mill with good results.

★The Eagle-Shawmut property near Chinese Camp, Tuolumne County, only important gold mine on the Mother Lode to continue production during the war, has been closed. Machinery and supplies are being offered for sale. The high and increasing costs of labor and materials and the price of gold are responsible. The owners, Miller and Clemson, of Los Angeles, had operated the property since 1938. The mill also treated copper-zinc ore mined at the Penn mine in Calaveras County and trucked to the Eagle-Shawmut.

OREGON

Placer mining continued late in season. Gold is chief metal product. Bonanza mine continues quicksilver output

★Several placers in southern Oregon were reported to be operating late in the season. Three giants were being used by O. N. Snavley, near Buncom, at the Federal placer, two by H. McIntosh, when water was available, at the McIntosh placer on Coyote Creek, and one by each of the following: W. C. Schleigh at the Jason placer and M. H. Davis at the Blue Channel, both on Coyote Creek, and L. O. Krewson, near Wolf Creek, at the Hole-in-the-Ground placer.

★Production at the Bonanza quicksilver mine, near Sutherlin, continues to be approximately 100 flasks per month. About 20 men are employed and development work is continuing.

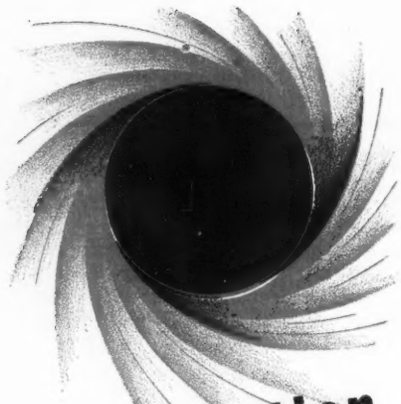
★Gold production in 1947 was 18,780 fine oz., according to the Bureau of Mines, compared to 17,598 in 1946. That of silver was 33,000 oz., compared to 6,927. The copper output was only 16,000 lb., the same as the year before, while lead production amounted to 22,000 lb., compared to 4,000 lb. in 1946. The total value of the four metals in 1947 was $693,721, compared to $624,231 in 1946.

★The Copper Queen mine, Josephine County, shut down since 1941, has been purchased by Robert Cannell, of Semi, Calif. It is to be mined by an open-cut method.

WASHINGTON

Industry opinion divided on premium price plan. More power for Metaline district will help mining there

★In 1947, according to the U. S. Bureau of Mines, Washington lead production was up 54% over 1946, and was exceeded only in the 1943-44 period. Three properties produced 84%, namely, American Zinc, Lead & Smelting Co., Pend Oreille Mines &



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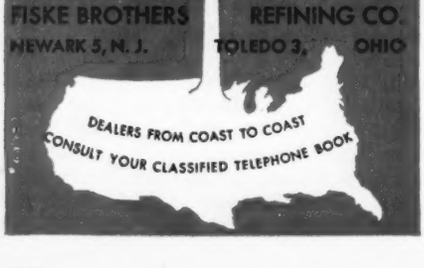

Washington (*Continued*)

Metals Co., in Pend Oreille County, and the Bonanza mine, in Stevens County. Other lead producers were Kaaba Silver-Lead, Metaline Mining & Leasing and Zenith Mines. Zinc production was up 20% over 1946, the output being higher than in any full peacetime year. About 97% of the State's production came from the American Zinc, Pend Oreille, Goldfield Consolidated, Howe Sound, and Metaline Mining & Leasing properties. Production of silver was up 10%, all leading producers showing gains except the Holden, which had a shutdown. The Knob Hill led in silver output. Others supplying that metal were the Holden, Kaaba, Aurum, Cleveland, Young America, and Bonanza. Gold production was down 33% and copper was down 52% under 1946. Gold was the lowest since 1936. Almost all of the gold in 1947 came from the Knob Hill, Holden and Aurum mines. Knob Hill led, due to Holden's non-production for more than six months, when only development was done. Copper production was the lowest since 1937, the decrease being due chiefly to the cessation of zinc-copper production by Howe Sound.

★Various operators have said that the increase in the price of zinc is good news. According to Frank Marr, of Spokane, director of Sheep Creek Gold Mines, zinc producers will benefit materially. "They will get about 83% of the 1½c. increase," he said. "The approximate ¼c. is metal loss."

★Four Salt Lake City mining men, Oscar Friendly of Park Utah Consolidated, James Wade of Tintic Standard, James Ivers of Silver King Coalition, and Otto Herres of Combined Metal Reduction, met with a few directors of the Northwest Mining Association in Spokane, in January, to discuss a tentative draft of a proposed bill concerning premium-price payments for base metal production. Association has been opposed to subsidies on principle, and according to Rowland King, president, and Roger O. Oscarson, executive secretary, no approval was given to the plan of the Utah officials. The latter also met with the industry's leaders in Wallace, Idaho.

★Evan Just, editor of *Engineering and Mining Journal*, New York, gave the chief address at the 21st Annual Mining Institute of the School of Mineral Engineering at the University of Washington, in Seattle, in January.

★U. S. Attorney Harvey Erickson has announced that the trial of seven persons indicted for allegedly defrauding more than 100 Northwest investors of about $250,000 in an "atom gold" scheme will be held in Spokane or Yakima, in April or May. The defendants, indicted by a grand jury in Spokane, are charged with conspiracy, using the mail to defraud, and violation of the Securities Act.

★According to Albert Ray, of Spokane, Tungsten Mining & Milling Co., with J. C. Cooper, of Wellpinit, general manager, will start work this spring at the old Germania mine, near Fruitland, with about eight men. The mill is to be reconditioned to handle 15 to 50 tons.

★Increased electrical power was to be available to the Metaline mining district when Bonneville Power's new transmission line was to be energized on February 5. According to G. H. Bell, Bonneville's Upper Columbia district manager, the new line from the Spirit substation will carry 115,000 kv. This will permit more rapid expansion of the mining industry in that area.

★Early opening of the Mead magnesium plant, near Spokane, was made difficult by reports from Washington that bids for the lease must be approved by the Department of Justice and later by the WAA advisory board. Electro-Metallurgical Co. of New York, Pittsburg Metallurgical Co. of Niagara Falls, and Chromium Mining & Smelting Corporation of Ontario and Buffalo, N.Y., are reported to be among the bidders. Senator Magnuson reported Jan. 31 that Dr. Paul J. Raver, Bonneville Power Administrator, has extended the date for holding a 12,000-kw. block of power for the operator of the Mead plant from Feb. 15 to March 1. In Spokane it was said that even 12,000 kw. would be below the requirements for capacity operation.

★Wellman Clark and Elmer Johnston, counsel for Northwest Mining Association's mine finance committee, went to Denver for the meeting, Feb. 2, of the national resources economic subcommittee, prepared to recommend that the exchange act be amended to permit free trading in over-the-counter stocks, and that "drastic" rules preventing issuing and sale of mine and oil stocks be eliminated from the Securities Act. "As it is now, the quotations do not reflect the true market," Mr. Johnston said. "We will ask that the regulations pertaining to fraud and misrepresentation be kept on the books but we want to give new companies a freer hand to get going." According to Rowland King, president of the Association, Clark and Johnston will take no part in the discussions of the premium price plan on which there is a sharp division of opinion among mine operators.

★Sale of Double Eagle Mining Co.'s magnesite deposits, in Stevens County, was to be considered at the company's annual meeting, at Valley, Feb. 17, according to A. J. Diedrich, secretary-treasurer.

★Operation of Kaiser's Trentwood aluminum rolling mill was suspended Jan. 6, because of a fire. Much of three days was lost but J. R. Meek,

works manager, said the monthly quota would be made up by working extra shifts. The site for the aluminum foil mill being brought from Germany has not been determined, according to Mr. Meek.

★Work was begun in late January on remodeling to provide for installing several units of the new Kaiser Aluminum Research Laboratories. The work, being done by Hansen & Parr Construction Co., will be completed within two months, according to Research Director Dr. Paul Zeigler.

★Empire Chemical Corporation plans to construct two superphosphate fertilizer plants at a total cost of about $500,000, one in and near Spokane, and the other in the south-central part of the State, according to W. Anderson, manager, Butte, Mont. The phosphate rock will come from Maidenrock, Mont., and electricity from Bonneville or Grand Coulee dams.

★Federal Judge S. M. Driver recently ordered distribution of the $34,452 condemnation award made by the Government, in 1942, for dolomite deposits for magnesium production on 360 acres of a farm, in Stevens County. Of this sum Spokane Portland Cement Co. and the estate of W. N. Bennett, mortgagors, were given $27,648.

★West Coast Mineral Association, at a recent meeting in Seattle, approved Joint Senate House Resolution No. 162 providing for canceling Secretary of the Interior's power through the 1936 Wheeler-Howard Act to create large Indian Reservations in Alaska, and to rescind those made during Harold Ickes' administration.

IDAHO

Copper may become important factor—Sidney mine has good year—Day Mines reopening Hercules mine

★Rock Creek Mining Co., a subsidiary of Hecla, has started work on a new deep tunnel development on Rock Creek, midway between Wallace and Mullan, where Hecla owns a two-mile-square area in the eastern extension of the silver belt. They have installed a new electric-driven air compressor, erected mine buildings, graded roads, and started a 7x9-ft. tunnel, which will be extended for an undetermined distance. Objective is an oxidized siderite vein, uncovered by bulldozer prospecting last summer, which assayed up to 50 oz. silver and 14.4% lead. It will be reached in about 3,000 ft. and at 800 ft. depth. Second objective is a wide sheer zone 5,000 ft. from the portal, which shows good lead values over an extensive surface exposure. It is at 4,500 ft. elevation, and will be opened by the tunnel at a 1,000-ft. depth. It is planned to employ four 6-hr. shifts of miners

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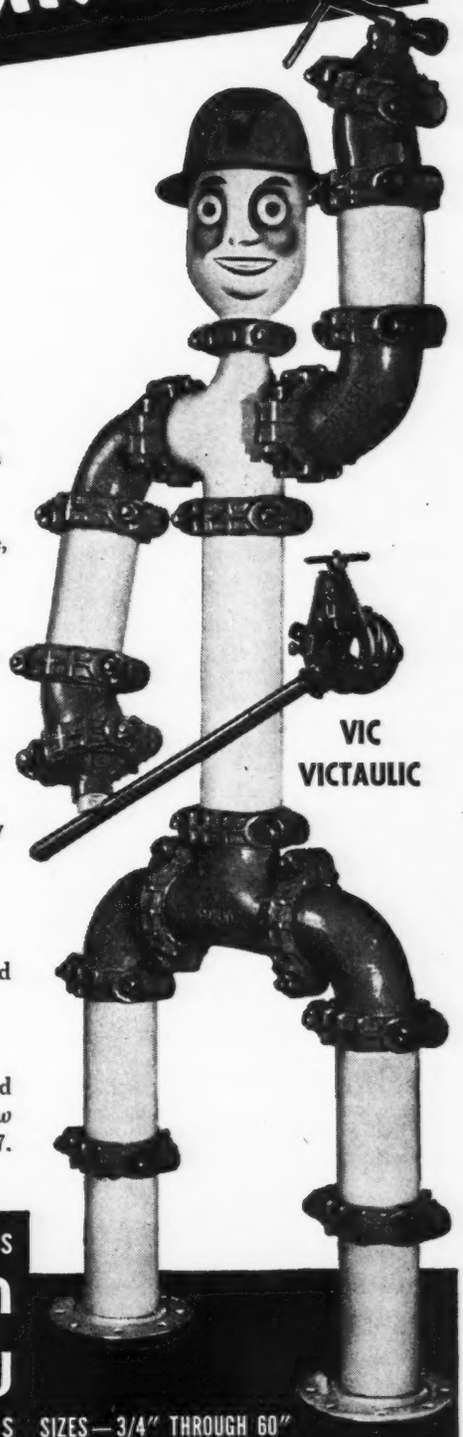

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Idaho (*Continued*)

and make around 30 ft. or better per 24-hr. day.

★Sunshine Mining Co. has started a new crosscut on the 3,700 level to intersect the Yankee Girl silver vein system, originally opened to production from the 3,100 level. Stoping operations indicate that the vein apexes a few levels above the 3,100, so it was decided to develop it from the 3,700 level. Sunshine holds the majority interest, while Metropolitan Mining Co. owns one-seventeenth.

★Bunker Hill & Sullivan company has declared its first dividend for 1948, amounting to 25c. a share and totaling $327,000, payable March 1 to stockholders of record Feb. 3. The company's total dividend record to date is $63,215,527.

The company's Kellogg smelter is now producing 5,000 tons of lead per month, nearly double the output of five months ago, according to J. B. Haffner, manager. The value of the lead output is more than $1,500,000 monthly, and provides evidence that the mines of the Coeur d'Alenes have greatly increased their production, because the bulk of the smelter's lead product comes from district mines. About 1,350 men are employed in the smelter and affiliated units.

The company now has 1,800 men on the payroll, representing an increase of 450 over a year ago. About 450 men are working underground, part of whom are engaged in preparing the block caving system to be used in mining low-grade ores on a large scale in the mine's old upper workings. Ordinarily, Bunker Hill's mine capacity is about 1,800 tons daily.

★J. A. Mecia, general manager of the Ima tungsten mine, Patterson, Idaho, under lease to Bradley Mining Co., announces that the plant, which was recently burned, will be immediately rebuilt and is expected to be in operation within six months. Loss occasioned by destruction of the old plant is estimated at $300,000. The new mill will be nearer the town of Patterson.

★Mine rescue crews are being trained at the Bunker Hill, Page, Sunshine, Heela and Morning mines in the Coeur d'Alene district by James Wilson, superintendent of the district mine-rescue station, and R. K. Ward, of the Seattle branch of the U. S. Bureau of Mines. Different groups of men are being trained at each plant who will be available in case of accident.

★Silver Dollar Mining Co. has completed its shaft to the 2,800 level. A station is being cut preparatory to driving a 100-ft. crosscut to the Chester vein which assayed 46 oz. of silver at 2,500 level.

★U. S. Bureau of Mines preliminary annual figures show that the Coeur d'Alene district in 1947 produced 95% of Idaho's zinc output, 95% of the lead, 90% of the silver, 80% of the copper and 33% of the gold. Total value of mineral output of the state was $52,456,470. Of this the district is credited with $47,002,780. Gold output was increased 51% during the year, lead, 26%; silver, 53%; copper, 41% and zinc, 10%. During 1947, 49 local mines and tailings plants in the district produced $20,629,800 worth of lead; $17,620,200 in zinc; $8,172,950 worth of silver; $508,080 in copper and $71,750 worth of gold.

★Coeur d'Alene Mines Corp. is diamond drilling from the 2,800 level to intersect the vein at the 3,200 level. It shipped 1,164 tons of high-grade silver-copper concentrates from the 2,200 level during December. The prospect crosscut being driven south from the 2,800 level has now been advanced 2,931 ft.

★Lucky Friday Silver-Lead Mining Co. shipped 5,000 tons of mill ore to the Golconda custom mill early in January. The resulting silver-lead concentrates shipped to the East Helena smelter netted approximately $120,000. Three cars of zinc concentrates were also shipped to the Sullivan zinc plant. Production is continuing at 50 tons daily. A new electric hoist has been purchased and a station and skip pockets are being cut on the 1,400 level, in preparation for sinking the shaft further.

★Edith-Murray Mining Co., in the Murray section of the Coeur d'Alene district, reports development of the former Terrible Edith vein has progressed to a point where steady shipments can be made to a custom mill, preferably in the Murray section. Their only other outlet is to truck the ore over two ranges to custom mills in the main part of the district.

★Pine Creek Lead-Zinc Mining Co., whose Little Pittsburg mine in Pine creek is under lease to Denver Development Co., was the first company in the district to declare a dividend in 1948. A semi-annual dividend of 3% on its preferred stock, amounting to $2,028.30, and a semi-annual dividend of 2c. per share on the outstanding common stock, amounting to $11,520.42 were declared. This brings the total dividends paid to $83,345, all of which has accrued from royalty payments.

★The newly organized Day Mines, Inc., is operating five modern mills in the Coeur d'Alene district with a combined capacity of 1,400 tons daily. The capacity of its Monitor mill in the Beaver district was increased from 215 to 490 tons daily. This mill handles all the zinc-lead ores from the company's Beaver district mines, which have a haulage outlet through the Carlisle tunnel. The Hercules mine has been unwatered to the 600 level, with 600 ft. to go. Unwatering is done with skips at the rate of 2,000 gpm. over a 24-hour period. The mine had been abandoned 20 years ago, after producing more than $21,000,000, because the ore became too low grade on the 1,200 level. In the light of other developments in the district this may have been just a lean zone, hence the decision to go deeper in search of high-grade ore.

★With increased output of silver-copper ore from the silver belt, production of copper as a by-product may soon become an important factor in the annual mineral output of the Coeur d'Alene district. Copper has never been mentioned in any of the district's annual reports of mineral output, yet has amounted to more than 9 million dollars worth.

The Snowstorm mine at Larson was the only real copper mine in the district, but the tetrahedrite silver ores from the Sunshine, Coeur d'Alene Mines and others in the silver belt contain an appreciable amount of copper. The Snowstorm was operated from 1904 to 1914, produced 195,781 tons of copper ore with a gross value of $8,356,186, and a net profit return of $1,509,226. Dividends totaled $1,457,647. The orebody, 40 ft. wide and 700 ft. long, was in a bedded vein of Revett quartzite. It was cut off apparently on a fault plane, and its extension never located.

Coeur d'Alene Mines Co. has produced, from 1939 to Nov. 30, 1947, 10,670,907 lb. of refined copper which would be worth over 2 million dollars at present prices. Sunshine Mining Company's copper production dates over a period of years and has come a a by-product from different orebodies under Sunshine management and the Sunshine itself. Total by-product copper from these, according to the company's official figures, is 28 million pounds of refined copper, worth more than 5 million dollars.

★Sunset Minerals Mining Co., operating the Liberal King mine in Pine Creek under lease, has a winze down 200 ft. below the 1,000 level, where drifting on the vein is in progress. A better grade of ore is reported than above the 1,000 level. The ore on the upper levels is a fine-grained zinc-lead ore that must be ground to 200 mesh for successful separation.

★Highland-Surprise Mining Co. with a 200-ton daily output of zinc-lead ore from the Surprise vein, has opened a new vein parallel to and 40 ft. from the old vein. The vein was found by diamond drilling and proved by drill holes for 250 ft. A crosscut was driven to it from the 700 level. At the intersection it is 15 ft. wide, five of which assayed 8% lead and 15% zinc, while the rest proved to be good mill feed. The vein has been worked a considerable distance by a 20-ft. drift. A second crosscut to the new vein is being driven at the 1,000 level.

★Hope Silver-Lead Mines, Inc., at Clark Fork, has resumed milling ore from the Elsie K. vein after suspen-

sion of a year or more, while a deep shaft was put down on the Pearl fault structure, which first was diamond-drilled by the U. S. Bureau of Mines. A crosscut is now being driven to connect this shaft with the Elsie K. workings.

★Sidney Mining Co., operating in the Pine Creek section of the Coeur d'Alene district, had a gross production income of $2,680,712 in 1947, according to W. T. Simons, president and manager. Lead production totaled 7,302,254 lb. with a value of $1,084,430; zinc production totaled 14,509,174 lb. with a value of $1,431,561; payments for gold totaled $1,648 and for silver $163,037.

This was Sidney's first full year of production since the mine was reopened under present management. It was operated by leasers during World War I, during which the company declared dividends totaling $473,685 on income from royalties. The mine was closed during the depression and remained closed until a few years ago, when W. T. Simons, secretary for the leasers and the company, reopened it and levied a small assessment to start work. W. A. Beaudry, manager, started drifting on the vein on the No. 5 level, east of the former producing area. Enough ore was found to meet expenses.

The U. S. Bureau of Mines diamond-drilled the vein east of the tunnel workings. A continuation of the No. 5 level drift confirmed the drilling results, and opened an orebody more than 1,000 ft. in length and from 5 to 15 ft. wide. A modern 300-ton mill has since been erected and a long crosscut tunnel has been driven on a level with the mill, to open the vein 400 ft. below the No. 5 level. This new level is called the Red Cloud tunnel. Where it strikes the vein, it shows a body of high-grade ore about 15 ft. wide.

MONTANA

New section of National Safety Council organized—Anaconda completes new film of company operations

★A Montana Mining Section of the National Safety Council was formed in Butte Jan. 11. W. H. Myers, of Virginia City, president of the Madison County Mining Association and the U. S. Grant Mining Co., was elected president; R. B. Shelledy, Garrison, president of Montana Phosphate Products Co. and vice president of the Mining Association of Montana, was eleeted vice president, and Prof. Oscar A. Dingman, of the Montana School of Mines, was elected secretary-treasurer. J. L. Boardman, Butte, chairman of the bureau of safety of Anaconda Copper Mining Co. and general chairman of the national mining section of the National

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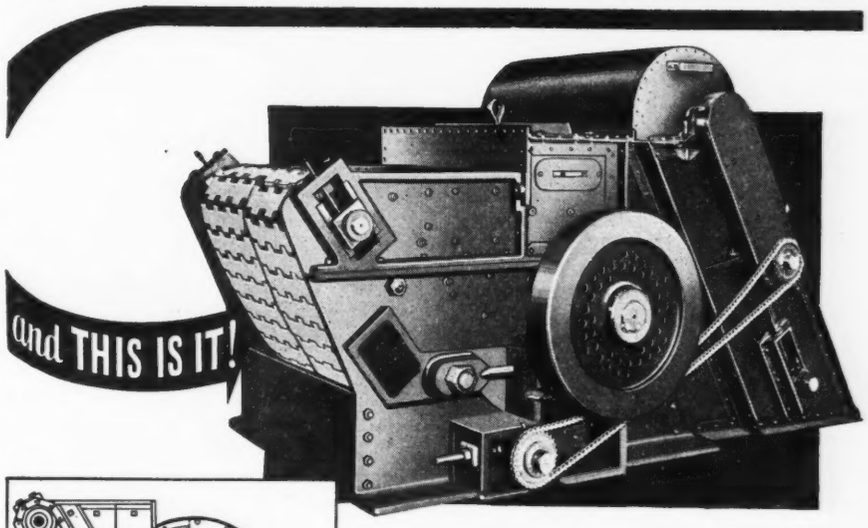

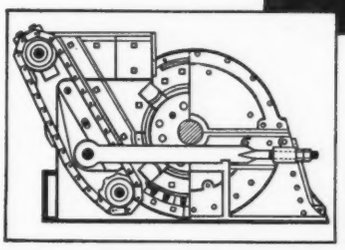

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Montana *(Continued)*

Safety Council, was appointed general program chairman of the Montana section. A. E. Haeseler, general manager of Mike Horse Mining & Milling Co., at Mike Horse, was appointed vice-chairman of the program committee for the Helena district. R. J. Armstrong, Garrison, general superintendent, Montana Phosphate Products Co., was appointed program vice-chairman for the western Montana mining districts.

★Boaz Mines, Inc., has been incorporated in Washington by W. T. Dunn, Al Pratt and Jess Hahn, of Spokane. The company has taken over the Boaz mine, near Norris, Madison County, Montana, and owns stock control of the Heleene Mining Co., with property adjoining the Boaz. E. W. Stevens is superintendent.

★Anaconda Copper Mining Co., after two years' study and work, has completed a natural color film entitled "Copper," which, in 35 minutes, depicts the company's Montana operations. The film shows the municipalities of Butte, Anaconda and Great Falls and the timber acreage and timber mills owned by the company. Outstanding is some remarkable photography of underground mining, which shows a closeup of a blasting round in which the short flames coming from the holes are visible. Every phase of operation is clearly represented. Eventually the film will be available to technical organizations or civic clubs by application to E. W. Savage, care of the Anaconda company in Butte.

★James Ivers, president of Utah Mining Association and vice president of Silver King Coalition Mines; Otto Herres, vice president, Combined Metals Reduction Co.; James Wade, vice president and general manager, Tintic Standard Mining Co., and O. N. Friendly, vice president and consulting engineer of Park Utah Consolidated Mines Co., all of Salt Lake City, met with a group of members of the Mining Association of Montana in Butte, Jan. 12, to discuss legislation covering government incentives for exploration and development and for marginal producers of strategic minerals.

★The Mining Association of Montana re-elected the following officers for 1948: A. V. Taylor, Jr., Philipsburg, president of Taylor-Knapp Co., president; G. T. Vandel, Jardine, manager of Jardine Mining Co., first vice president; R. B. Shelledy, Garrison, president and manager of Montana Phosphate Products Co., second vice president; Dr. Francis A. Thomson, Butte, president of the Montana School of Mines, chairman of the executive committee; R. P. Porter, Helena, president of Porter Bros. Corp., member of the executive committee, and Carl J. Trauerman, Butte, secretary-treasurer.

Photo from Newmeyer

BULL DOMINGO LEAD-ZINC MINE, a former producer near Silver Cliff, Colo., is now under lease and option to C. Erb Wuensch, of San Francisco, and associates. Work is under way to unwater the mine to the 800-ft level and investigate ore showings

★Universal Zonolite Insulation Co., Libby, Lincoln County, has changed its name to Zonolite Co. This firm is the largest producer of raw and processed vermiculite in the United States. Mining operations are carried on by quarrying with gasoline-driven shovels and the vermiculite is milled and some of it roasted at the Libby plant. Raw vermiculite also is widely shipped to agents who have their own roasting plants. A. T. Kearney, Chicago, is president, and J. B. Myers, Libby, vice president.

★Anaconda Copper Mining Co. is employing 200 men on its Greater Butte Project to mine low-grade ore, according to E. S. McGlone, vice president in charge of western operations, in an address before the Butte Rotary Club Jan. 29. This work is going on in addition to mining higher-grade ore. Mr. McGlone further stated during the past six months his company had increased its Butte working force by 1,300 men, but could use 1,500 additional.

★Reflecting appropriations by the last two legislatures, Montana Bureau of Mines and Geology has made important forward strides, especially during the year just closed, when desirable personnel became more available. Among the projects slated for completion in the near future is the long planned geologic map of Montana. This has been a major project of the Bureau for years and is being completed in cooperation with the U. S. Geologic Survey. Due to the great area of the state and Montana's wide range of geologic formations, the work has taken time. The near future will see a geologic map of the entire state in color.

Another project on which the Bureau has been working for years and has now completed, is the study and mapping of the Hecla mining district, located at the head of Trapper Creek in the Pioneer mountains. Additional mapping of the Highland mountains south of Butte, comprising an area of 150 sq. mi., is now nearing the finish. This was started before the war. Other mining districts to be included in this program are the Marysville, Upper Blackfoot, Independence, in Park and Sweet Grass counties; St. Regis-Superior, Clinton, Wickes-Corbin and several in Beaverhead County. A detailed study of placer deposits in Montana was undertaken in 1946.

COLORADO

Lateral to Cresson mine from Carlton tunnel is started. Diamond drilling is under way in Bull Domingo mine

★J. T. Stroehlke reports finding lead-zine ore, containing some gold and silver also, at 75 ft. with a rotary drill on the edge of the Silver City district about half a mile west of the Passiflora group. Three holes were drilled to approximately 100 ft.

★Edwin O. Botten, of Cripple Creek, is engineer in charge for Mineral Processors, Inc., operating the Trail tunnel, under lease from United Gold Mines Co., and the Dexter mine under lease from Hamlet-Dexter Corp.

★Stoskholders of Rico Argentine Mining Co., in Dolores County, have received a dividend of 5c. a share Jan. 14. Payments in various amounts have been made to stockholders for the past seven years and the total disbursement now tops $400,000.

★Gold Queen Mining Co. has purchased the Lucky Strike group of 14 claims of 95 acres about 16 miles from Gunnison. Some machinery has been purchased and work started on the shaft. According to Roy Knowles, president and manager, 1,500 tons of milling ore has been blocked out.

★The Country Boy zinc mine, of Garvie-London Co., employing 40 men, has closed down, after operating five years. Its chances are said to have been killed by the veto of the Premium Price Plan. A large tonnage of undeveloped zinc ore is said to remain.

★Work on the 6x8-ft. Carlton tunnel lateral to the Cresson mine at Cripple Creek has started, according to Mel Salsbury, superintendent of the Portland. The work will be done through Portland No. 2 shaft. The lateral will start 500 ft. from the Portland station on the 3,300 level and go to a point 3,800 ft. away and about 700 ft. under the bottom of the present Cresson shaft. The tunnel level here will be approximately 3,000 ft. below the collar. The Cresson is the third major mine of the district in which new territory has been opened for development as a result of driving the Carlton draining tunnel. The others were the Ajax and the Portland. After the Cresson, the Vindicator will be drained.

★At the old Bull Domingo mine at Silver Cliff, now under lease to C. Erb Wuensch and associates of San Francisco, diamond drilling is under way on the 250-ft. level. The drill holes are more or less flat. The lessees have been unwatering to the 800-ft. level to examine known bodies of lead-zinc ore existing between the 250 and 550 levels.

★Colorado production of gold, silver, copper, lead and zinc increased in 1947 over 1946, according to the Denver office of the U. S. Bureau of Mines. Gold output showed 17% increase and that of silver 13%. Copper production rose 22% and lead production 7%, output increasing materially after the ending of the Premium Price Plan on July 1, chiefly because several operators shifted underground work to higher-grade sections. Zinc production increased 4%, though its value was slightly less than in 1946.

★The New Monarch lease on the property of New Monarch Mining Co. at Leadville has been taken over by Charles Hopkins and associates, who plan more active operations. The name will remain the same. Plans include rehabilitating the Winnie shaft, opening up additional areas for subleasing, and connecting the Winnie and Valley shafts of Valley Mines, Inc., to facilitate handling ore and improve ventilation.

★Another new operation is the Dahl-Shirk lease on the Fanny Rawlings property in South Evans Gulch, Leadville, which has been operating five months. The work is at 465 ft. depth

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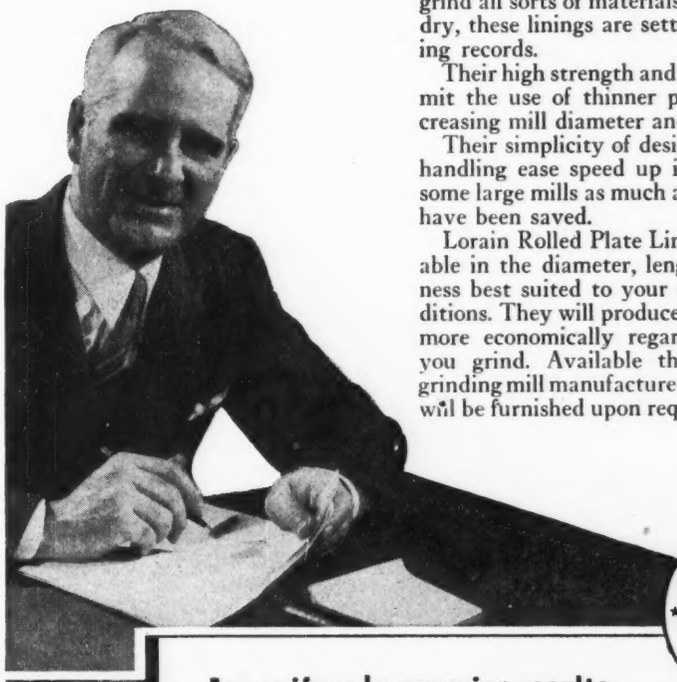

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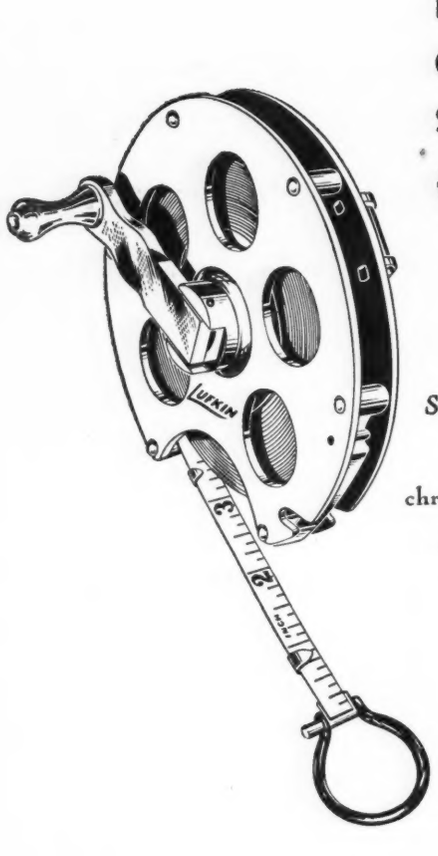

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Colorado *(Continued)*

and the lessees plan to go to 540 ft. On reopening after six years shutdown, considerable water had to be pumped out.

★Although cold weather has forced suspension of hydraulic mining operations in the Leadville area, the General Gold Corporation and the Natomas Co. have acquired leases looking to expanded operations in the spring. General Gold operated the dredges last summer and autumn on the Derry placer and the Hayden ranch.

★Operations at the Resurrection mine and mill at Leadville in 1948 will probably continue on about the same scale as in 1947. The mine, owned by Newmont, Hecla and U. S. Smelting, milled 70,000 tons of the company's own ore and an additional 40,000 tons from various shippers of the district.

★Central Mining and Development Corp., a new company in Gilpin County, has acquired the Success-Meeker Mining and Milling Co., which has been operating the Success-Meeker claims and the Pittsburg mine. The Central company has leases on properties at the head of Spring Gulch and is building a plant to make rock wool, using old smelter slag with spar and quartz.

UTAH

Freight increase eased. A new wage settlement reached for contract miners in Park City

★Nonferrous metals, ores and concentrates received preferential treatment from the Interstate Commerce Commission in recent freight rate increases granted, James K. Richardson, manager, Utah Mining Association, pointed out in a memorandum.

"Although the I.C.C. granted railroads a 10% emergency rate increase Oct. 13, 1947, and a second 10% increase Jan. 5, 1948, copper, lead and zinc ores and concentrates received an exception," Mr. Richardson noted. "This exception was that rates on nonferrous ores and concentrates were increased 20c. per gross or net ton over rates in effect Jan. 1, 1947, not 20%. For example, a $10 gross-ton rate is raised to $10.20 rather than to $12, as would be the case on a percentage increase." The general traffic managers of the American Smelting, Anaconda Copper, St. Joseph Lead, and Phelps-Dodge companies gave invaluable assistance in preparing exhibits and other material, he said.

★Utah's iron-ore output in 1947 more than doubled that of 1946, with 2,741,000 gross tons compared with 1,317,176 gross tons in 1946, U. S. Bureau of Mines data show.

★Columbia Iron Mining Co., U. S. Steel subsidiary supplying Geneva Steel Co., has acquired additional iron ore holdings in Iron County, Dr. Walther Mathesius, Geneva president, has announced. A lease has been signed with Milner Corp., Salt Lake City, covering claims near property owned or leased by Columbia. The lease provides for an exploration program with an initial payment in advance royalties of $600,000. Other reserves in that area have been acquired from A. E. Moreton and associates, Salt Lake City, for an initial payment of $250,000.

★Kaiser-Frazer Corp. has purchased for $1,500,000 a blast furnace at Ironton and 500 beehive coke ovens in Carbon County. Kaiser plans to make pig iron at the plant acquired from War Assets Administration for shipment to his Fontana, Calif., steel plant. The furnace adjoins the Columbia plant now operated by Geneva Steel Co. It was transplanted here during wartime from Joliet, Ill., and operated for a short time by Geneva.

★Sale of 150,000 shares of New Quincy Mining Co. stock to its president, Nick Floor, was ordered set aside Jan. 16 by Judge Ray Van Cott. Plaintiffs R. T. Runswick, M. B. Johnson and S. B. Tuttle, charge that the sale was not in the company's best interests. The property is in Summit and Wasatch Counties.

★Following protest by the Utah Department of Publicity and Industrial Development and others, the U. S. Bureau of Mines has held in abeyance until after July the projected transfer of the Bureau's alloy section from Salt Lake City to College Park, Md. The Department said the transfer would mean a loss of $100,000 a year to the state in payrolls and expenditures for equipment and supplies.

★The defunct Mountain City Copper Co., Rio Tinto, Nev., is entitled to a federal tax refund of $50,258 with interest from March, 1947, U. S. District Judge T. D. Johnson ruled Jan. 24. The company sued, claiming it was in the development stage between Oct. 1, 1935 and Feb. 16, 1936, while the Bureau of Internal Revenue contended the company was a producer and, as such, income on its ore sales was taxable.

★A referendum vote among members of local unions affiliated with district union No. 2, International Union of Mine, Mill & Smelter Workers, was called for late in January to determine disposition of a balance of $73,000 left in a 1946 strike fund raised by the locals. Three locals, two in the Uintah basin gilsonite area, and one at Pioche, Nev., which have seceded from the international union, retain

an interest in the strike fund by terms of a trust agreement and are among those pressing for division of the fund balance.

★A 10¾% pay increase on the excess over base pay earned by contract miners has been agreed upon by mining companies in the Park City area and MMSW. Prior to the settlement reached Jan. 29, with Silver King Coalition, district operators had posted notices terminating contract mining at the end of the month in the absence of an agreement. A 10¾% increase in base pay became effective last summer. The same percentage increase now is applied to excess over base pay earned by contract miners.

★Blackbird Mining Co., which began development of a manganese property eleven miles southeast of Marysvale Oct. 1, 1947, is shipping more than a car a week to the Geneva steel plant, P. D. Barrett, Ogden, company secretary, reports. A new road has been built from the Denver & Rio Grande Western station to the property. Production of manganese is being increased. Don Stocks, Marysvale, is president.

WYOMING

Resumption of phosphate operations expected—Bentonite and trona developments are progressing

★With bentonite being shipped to Chicago from the Iron Creek section of Wyoming, interest in the possible deposits of this mineral is increasing daily. The bentonite is dried and sacked for shipment. There is a mill near Iron Creek. Other mines are located at Upton, in northeastern Wyoming.

★With the possible employment of 1,000 men at the trona plant of Westvaco Chlorine Products Co., it is expected that output will average about 5,000 tons of trona per day when full production is reached, according to J. W. Downey, superintendent. It may take a year before plans can be realized. Exploration is being done below surface to define the deposits. At 1,500 ft. depth, drifting is under way from the original shaft. Tests are being made on the material brought to surface.

★With an annual yield of 1,556 oz. of gold for 1947, and 100 oz. of silver for the same period, the production of gold in Wyoming showed a marked increase over 1946, when the yield was 107 oz. Silver output for 1946 was only 26, as compared with 100 oz. for last year. Three mines in Fremont County were responsible for the increase. Mica Mountain Mines, Inc., accounted for the additional production with the operation of the Carissa

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Wyoming *(Continued)*

mine, and a new 75-ton amalgamation-cyanidation mill. Development is being continued at the Carissa, east of South Pass City, a name long familiar in connection with rich strikes in Wyoming. Last March a mill was completed. Wyoming's 1947 production of gold was rated at $54,460 and silver at $91. In 1946 the gold was $3,675 and silver $21.

★A new mining town has made its appearance in Wyoming, at Leefe, 25 miles west of Kemmerer. It will be situated in the center of large-scale phosphate mining operations. A crushing plant with a capacity of 250 tons per hour will be operated at Leefe. Plant facilities are expected to be adequate to permit the loading of 120 cars of phosphate per day. The project is being developed by the San Francisco Chemical Co., with D. L. King as general manager.

Additional milling equipment will be brought in from Montpelier, Idaho. The deposits at Leefe are reported to be much thicker than those at Montpelier, and amenable to large-scale strip mining.

NEVADA

Reopen Dan Tucker mine—Newmont Mining Corp. exploring gold property—Riley tungsten mine shuts down

★Summit King Mines, Ltd., highly productive until closed down by Order L-208, is resuming operation of its Dan Tucker gold-silver mine and 70-ton cyanide mill in central Churchill County. Ira B. Joralemon, of San Francisco, is president and P. G. Dobson, of Fallon, manager. Production is to start on the 500-ft. level. Summit King Mines is a controlled subsidiary of Bralorne Mines, Ltd.

★Eureka Corporation, unit of Ventures, Ltd., of Toronto, has sunk its four-compartment Fad shaft on Ruby Hill to the 2,250-ft. point. A 1,000-ft. crosscut is to be driven to ore found by deep diamond drilling. The 150-ton selective-flotation mill at the Mount Hope silver-lead-cadmium mine of Callahan-Zinc-Lead Co., 22 miles north of Eureka, has been leased. Its diesel plant, destroyed by fire last year, will be replaced. Mill equipment has been supplemented for treating ore from the Fad shaft.

★At Goldfield, Newmont Mining Corporation is continuing exploration of veins containing high-grade gold ore, 2,500 ft. west of the Florence shaft, which is leased from Deep Mines Co. It is reported Newmont will construct a cyanide mill near the Florence. A geophysical party, owned by Union Oil Co., spent a fortnight checking geology and the complex fault system of the Newmont-controlled area.

★Tonopah Development Co., exploration unit of Calumet & Hecla Consolidated Copper Co., has met with continued delay in its deep drilling program near Tonopah, being conducted by E. J. Longyear Co. Two holes have been drilled 1,500 ft. on the Tonopah King claim, 1,500 ft. apart, and a third was halted at 1,000 ft. by the loose "ravelly" nature of the limestone. R. I. Lavrooshin is engineer in charge at Tonopah and M. A. Diskin, former state attorney general, is agent in Nevada for Calumet & Hecla.

★U. S. Vanadium Corp. has closed its Riley tungsten mine in the Potosi district, Humboldt County, until the market improves, according to J. V. Horn, vice president. During the war the mine produced 80,000 tons of ore for the nearby Metals Reserve stockpile. Concentrated in the Getchell Mine plant, it was trucked 340 miles to U. S. Vanadium's refinery at the Basic Magnesium plant, Henderson. The company's Pine Creek mine and plant near Bishop, Calif., will supply tungsten requirements for the present.

★Nevada's 1947 production of the four principal non-ferrous metals was placed by the Bureau of Mines at $30,404,175, an increase of 12% over the 1946 output. Gold production was 87,200 oz.; silver 1,254,000 oz.; copper 95,290,000 lb.; lead, 14,660,000 lb.; and zinc 35,560,000 lb. Three producers, Kennecott Copper Corp., Consolidated Coppermines and Mountain City Copper Co., an Anaconda subsidiary, accounted for 98% of the year's copper output and for nearly one-half of the gold and silver.

★Nevada Equity Mining Co., controlled by Copper Canyon Mining Co., has acquired a large number of claims on rich Lander Hill, near Austin, in addition to its Equity group. The old Equity deep-level tunnel has been extended into this area and long-abandoned shafts of early silver producers have been repaired and equipped. New laterals extend to veins that were productive during the camp's bonanza period. R. H. Raring is managing engineer.

★Consolidated Chollar, Gould & Curry Mining Co. is operating an open-cut gold-silver mine and 500-ton cyanide plant at Gold Hill, on the Comstock lode. In removing overburden by surface blasting, a 100-ft. tunnel was driven into the hill of barren rock and in two short drifts 9,750 lb. of low-test powder was placed and detonated, with a small charge at the tunnel portal to seal it. F. V. Fempsey, manager, and Walter Reid, engineer, reported the blast caved 80,000 tons of waste material into the abandoned pit.

★Antimony ore of uniformly high grade has been produced at the Wall Canyon mine west of Round Mountain, Nye County, by N. L. Brown and M. E. Niece of Tonopah, who have some 3,000 tons stockpiled and are

completing construction of a 50-ton concentrator. The mine shows a substantial volume of stibnite.

★Equipment for a 100-ton mill for the Yellowgold property of George "Curly" Carr, 25 miles north of Beatty, Nye County, is reported assembled for early installation by Gold Engineering Co., of San Francisco. Carr and associates developed high-grade gold ore some months ago.

ARIZONA

Summit Alpha plans expanded output —Forest Service loses important test suit on mining patents

★The Summit Alpha mine of Arizona Metals Co., near Kingman, is driving a 1,000-ft. crosscut from the mountain side to intersect the Summit vein at an elevation approximately 500 ft. below the outcrops, according to R. R. Langley, president. Work has progressed about 700 ft., leaving 300 ft. to drive. On completion, it is Langley's plan to drift 1,500 ft. on the vein and put in one raise to surface. Another raise is also planned from the drift level to connect with development workings above the 300 level, from which area production has come during the past four years. The crosscut will open up 250,000 tons of ore in the vicinity of the intersection. Values are in lead, zinc, copper, gold and silver. The company expects to erect a 200-ton plant near the portal. Included in the program is the completion of a crosscut from the Alpha claim's lower tunnel to intersect a silver-copper dike on that claim and a short crosscut from the same tunnel to cut the Omega vein, which carries strong lead values.

Location and elevation of the Alpha tunnel, with respect to that of the Summit crosscut, is such that the ore from both workings can be trammed to a common point for milling. These developments will eliminate the expense of hoisting and pumping. With these economies and with the advantage of large-volume production, the values in the ore promise a substantial operating margin above production cost.

★Arizona established a new record in lead and zinc in 1947, and mined more copper than it has since 1943, according to the Bureau of Mines. Total production of these metals and gold and silver was valued at $179,957,900, the greatest since 1918. The State maintained its position as the top copper producer, and was also first in total value of production of all five metals. Production fell off during the last six months principally because operators were forced to suspend shipments after the end of the Premium Price Plan.

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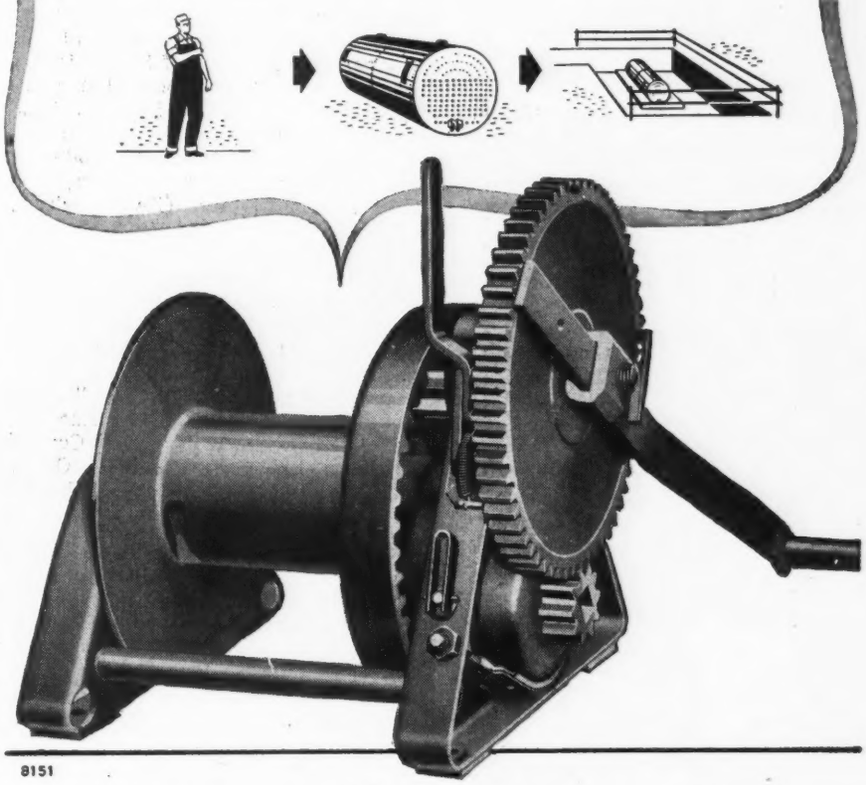

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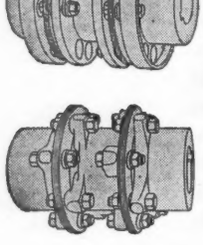

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Arizona *(Continued)*

year. They are the International plant at Inspiration, Magma Copper at Superior, A.S.&R. at Hyden, and the Phelps Dodge plants at Clarkdale, Douglas, and Morenci.

About 78% of the gold and 54% of the silver produced in Arizona in 1947 came from copper ore, and the rest principally from zinc-lead ore.

The 900-ton flotation mill at the Copper Queen branch of Phelps Dodge at Bisbee treated more lead-zinc ore in 1947 than in 1946 and remained the largest producer of lead and zinc in the State. Other large producers were: Mammoth-St. Anthony at Tiger, San Xavier (Eagle-Picher), south of Tucson, Iron King at Humboldt, and the Trench-Flux group near Patagonia. These five properties produced 86% of the lead output.

While most of the copper ore mined was treated in Arizona smelters, crude lead ore and concentrates were shipped to the lead smelter at El Paso, and zinc concentrates to the smelters at Amarillo, Dumas, and Corpus Christi, Tex., Bartlesville, Okla., Great Falls, Mont., East St. Louis, Ill., and Fort Smith, Ark.

★In a decision handed down by F. W. Johnson, director of the Bureau of Land Management, a Forest Service protest to the patenting of nine Long Valley manganese claims was rejected. Almost simultaneously, the Bureau of Mines issued a detailed report on the treatment of Long Valley manganese ores. These deposits contributed approximately $100,000 worth of manganese during the war, of which about $70,000 was shipped by J. Reed Denison. When Denison sought a patent in 1945, the regional forester protested on the grounds that mineral shown in place as provided by law was insignificant compared to the timber of the land.

The Forest Service contended that the ore could not be mined under peacetime conditions. It was pointed out that this may be true under present price conditions, but the Bureau of Mines report lists the ore as commercial.

Among the findings of the Bureau of Land Management were:

1. The Forest Service must prove its case in protesting a patent.
2. Where the evidence might justify a reasonably prudent man in trying to develop a mine, he is entitled to a patent.
3. Prospective value for mining purposes is sufficient basis for a patent.
4. Even though the evidence shows the land to be more valuable for its timber than for mining, that fact is immaterial if evidence of mineral value is clear and convincing.
5. An actual disclosure of commerical ore is not essential to effect an adequate discovery, or for issuance of a patent.
6. The fact that the timber might be more valuable would be an element only in determining the weight and creditability of testimony and the good faith of the applicant.

Arizona mining men, as a whole, feel that the main issue in the Long Valley case, the relative value of timber and ore, was decided in such a manner as to permit full development of mineral without Forest Service interference in the future.

★The Highland shaft of Southwestern mines at Courtland must be dewatered below the second level before production of copper ore can begin, according to Don Fournier, manager. Shipments are expected to be about 100 tons a day. The foundation for a mill has been laid.

★Operations, Inc., at Tombstone, has acquired control of several additional properties and is completing plans for mining. In addition to the San Juan in the Dragoon Mountains, it also holds the Compadre, near Patagonia; the Atlas, at Red Rock; the Pine-Zinc, in the Chirachuas, and the Tombstone Extension, east of Tombstone. Ore is to be shipped to a flotation plant in Tombstone.

★The 100-ton flotation plant of Athletic Mining and Smelting Co., Klondyke, Ariz., will soon be working on both company and custom ore. Developments in the Iron Cap and Head Center properties have been underway for several months. The high-grade ore from the latter will continue to go to the El Paso smelter, but Iron Cap ore will still be treated at the new mill. The principal values are in lead and zinc, with some silver. Raymond F. Orr is president. The district is producing an increasing amount of lead and zinc. Some smaller properties make occasional shipments. Among them are the Abe Reid, the Ora Hanna, and the Harwood mine.

NEW MEXICO

Higher zinc price helps some mines—Hornet mine again producing—Interest increases in certain nonmetallics

★Major Mineral Co. of Colorado is planning to reopen the Baca Bonanza and the Marshall Bonanza properties of the Cerrillos lead-zinc district, according to D. W. Schmitt, president and general manager. Work on reconditioning and cleaning up was to start late in January, with P. W. Rinehart, general superintendent.

★The advance in zinc price to 12c. has brought relief to several of New Mexico's producers who were hanging on the ragged edge. A survey shows, however, that this alone will not open new, small low-grade properties nor re-open those recently shut down for economic reasons. The margin is still too close.

★Inquiries in New Mexico for pumice, talc and kaolin multiplied in January. Representatives of eastern groups have been making surveys relative to purchase and operation of pumice mines and plants.

★The old Hornet mine, 7 mi. southwest of Hachita, Grant County, started producing late in January for Minerals Operation, Inc. Eugene Bruell is vice president and general manager and C. J. Vezzetti, general superintendent.

Starting last June, the company has unwatered, retimbered and cleaned out a good part of the old workings and verified blocked-out ore and ore exposures. A power plant has been installed to serve the mine and 100-ton flotation plant. The ore is predominately lead-zinc with values in silver and copper, and the mill is set up to make a lead concentrate containing the silver and copper and a zinc concentrate. Water is obtained from the mine. Thirty to 35 men will be required.

★Dunzer and Casner, operators of the old Courtney Mines east of Alamogordo, Otero County, have completed a railhead for shipping copper ore into Alamogordo. They expect to ship three cars a week.

★G. C. York, S. S. York, and B. S. Leonard, of Albuquerque, have incorporated the York Mining Co., under the laws of New Mexico, to develop, mine, and concentrate titanium minerals in granitic gneiss outcropping on two properties (18 claims in Socorro County, and 12 in Bernalillo County). Authorized capital is $500,000. Plans call for mining by open-cut methods at the rate of 1,000 tons per day.

Estimated expenditures are: $25,000 for diamond drilling, $225,000 for mining and milling equipment, and $25,000 for operating capital until sale of concentrates. The company also plans to explore and develop outcrops of gold-, silver-, copper- and lead-bearing veins on the properties in the future.

TEXAS

★Texas Gulf Sulphur Co. will open the first new sulphur mining operation in Texas in more than ten years with production from new properties near Wallisville, south of Liberty on the Trinity River. The holding of 3,000 acres may be expanded later. Consolidated Steel Corp., construction contractor, is shipping steel by barge up the Trinity to the plant site at Moss Bluff. Barge transportation will be utilized to ship sulphur when production is attained.

C. L. Orr is assistant manager in charge of construction and H. E. Treichler will be general manager. The operation is expected to furnish employment for 125 local residents.

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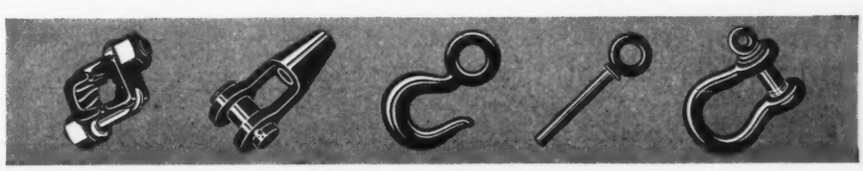

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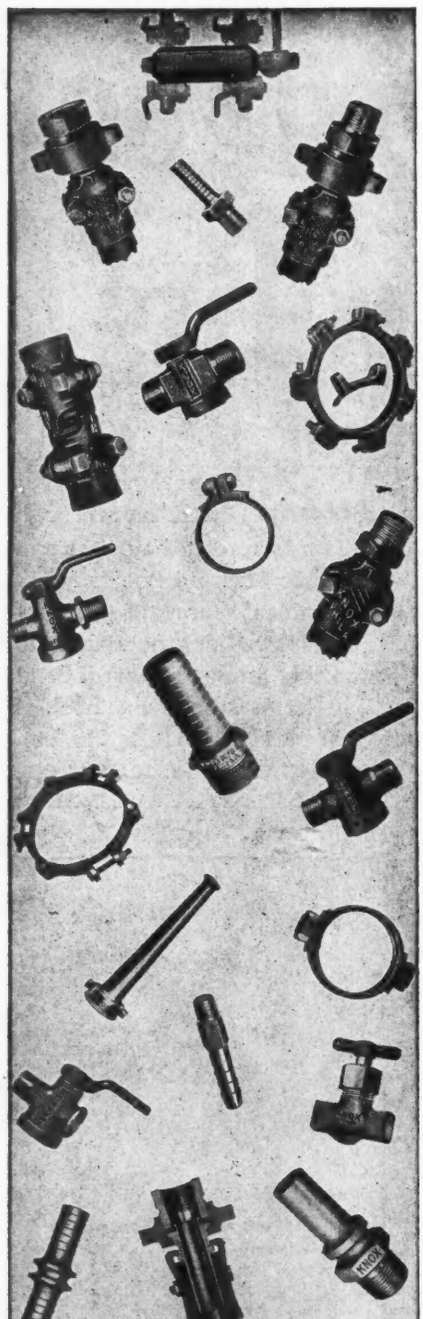

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TRI-STATE

Increased concentrate price stimulates metal raise—Pumping begins on Garrett land—Large sale made to outside interests

★On Jan. 20, Eagle-Picher Mining & Smelting Co. announced a $6-a-ton increase in the price of zinc concentrates, bringing the Central mill settlement basis to $78 a ton, effective Saturday, Jan. 17. In the wake of the Eagle-Picher boost, American Zinc, Lead & Smelting Co. on Jan. 21 advanced the slab-zinc quotation a cent-and-a-half a pound to 12c., St. Louis. Immediately following this action the price of zinc concentrates in the open market at Joplin was increased from $70.35 a ton, to $78 a ton, making the price consistent in all quarters and retroactive to the week ended Jan. 17. The Tri-State zinc-ore market is now at the highest level since March, 1917, nearly 31 years.

The immediate effect of the price increase in the district was the sale of stocks which had been accumulating for a few weeks. It was not expected to bring out any more production, but rather to sustain the present rate, provided that labor costs are not forced higher. Costs of production, including labor and supplies, now are at about the same level as under an average zinc-concentrate return of around $110 a ton under the Premium Price Plan. However, despite the loss of about $50 a ton following the expiration of premiums, there has since been a notable increase in labor efficiency, which has helped materially in maintaining the present output rate. Should costs mount further, considering the reduction in tariff protection the only hope of mining the remaining marginal ores of this district apparently lies in the return of a Federal subsidy program.

★Claud R. Jones, of Miami, president and general manager of the Marcia K. Mining Co., announced Jan. 31 the disposal of company holdings in the southeast part of the Picher mining field to Chicago interests. Although the consideration involved was not disclosed, the deal was the largest in recent years and was reported to have exceeded a quarter-million dollars. The company previously had acquired the assets and leases of the Davis-Big Chief Mining Co. Purchase of the Davis-Big Chief holdings was consummated Jan. 9, and the sale to the Chicago interests was officially closed Jan. 29, the latter being made retroactive to and effective as of the first of the year, Jones said. Jones did not disclose who the "Chicago interests" were, but did explain that he would continue in charge of operations indefinitely, at least until the new management took over. Plans of the new management with respect to future operations were not available. The leases involved in the transaction comprise 760 acres of Indian allotments administered by the U. S. Department of the Interior.

★Lavrion Mining Co. has installed two of three large submersible pumping units at the old Eagle-Picher Garrett shaft, three miles north of Treece, Kan., according to Clarence Zuvekas, of Joplin, owner and operator. Cost of the installations is expected to run around $50,000. Not only the performance of the new pumps in unwatering the property, but the development to follow, all of which is being financed by a $165,000 RFC mine loan, will be watched with keen interest by Tri-State and other mining men. Approval of the loan, which was applied for through the Joplin RFC office, was based on test drilling done on the lease by Zuvekas and later by the U. S. Bureau of Mines. Zuvekas put down nine drill holes and the Bureau five, which, over all, showed an average of from 5 to 6% in metallic recovery values of zinc and lead, he said. This drilling blocked out 375,000 tons of minable ore, with an additional half-million tons of possible ore, according to Zuvekas. The ore is to be shipped by rail to the Eagle-Picher Central mill at Cardin.

ARKANSAS

★W. E. Hester, production manager of National Lead Co., in a brief address before a dinner gathering in Little Rock, pointed out that the company's speculation in barite mining in Arkansas in 1942 had grown into a $3,500,000 plant. The dinner followed an inspection of new equipment and dedication of a spur track from Butterfield to the plant. By replacing the heavy truck haul formerly used, the company is able to bag and ship direct from the plant, thus increasing its output. Among those present were: Governor Laney of Arkansas; Gloyd M. Wiles, chairman of the company's mining committee; F. J. Shirley; Jean McCallum, vice president of the company's St. Louis division of Smelting and Refining; E. C. Long, assistant to Mr. Hester; Ward Evans and Mr. Christanelli.

GEORGIA

★The Triangle Stone Company and its subsidiary, Ladd Lime & Stone Co., both of Cartersville, are now under the same management. Col. L. J. Lempke, Raleigh, N. C., is the new general manager and H. C. Burgess, also of Raleigh, is plant superintendent. Col. Lempke said that the Cartersville plants have 50 million tons of limestone available.

IRON COUNTRY

R. T. Elstad, president of the Oliver Iron Mining Co., addresses the Hibbing Chamber of Commerce

★In a talk at the Hibbing Chamber of Commerce meeting Jan. 20, R. J. Elstad, president, Oliver Iron Mining Co., discussed the past history of Hibbing and its mines and the Oliver company's part in their development. He said that the Company is employing 7,500 men at present (nearly a third of whom are veterans of World War II), the largest number since 1931. The Hibbing district has 2,800 employees, the highest number for 25 years. During the defense and war years the Oliver company mined more than 225 million tons of iron ore, breaking all records, according to Mr. Elstad. Much of this ore was consumed by competing steel companies. The speaker stressed the diversified ownership of U. S. Steel Corp. stock to correct the impression that the company is controlled by a small group of men centered on Wall St. There are 228,000 stockholders, the average holding of common stock being less than 50 shares each; and of preferred stock approximately 50 shares each. There are about 100,000 women stockholders and nearly an equal number of men, with U. S. Steel and subsidiary companies' employees well represented. The list contains many insurance companies, schools, colleges, churches, charitable organizations (such as homes for children and the aged) cemetery associations, medical organizations, hospital societies, educational organizations, libraries and fraternal societies. The largest individual holding is less than 0.3% of the total number of outstanding shares. "No stockholder or group of stockholders own sufficient stock either to exercise, or to attempt to exercise, control over the corporation."

Mr. Elstad said that the 500-million-dollar program of construction, expansion and improvement planned by U. S. Steel, which would be shared by the subsidiary companies, including the Oliver company, would require financing from the nation's financial market. He commented on the work of the new research laboratory at Duluth and the experimental pilot plant at the Trout Lake concentrator at Coleraine, which is developing new methods for utilizing Mesabi marginal ores. Mr. Elstad's views on taconite concentration were summarized as follows: "We should realize that years of patient study and huge investments in plant and equipment will be necessary before this program can be made a reality. Additional laboratory facilities will be provided to further the study of conserving natural resources through the intelligent use of these marginal

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Iron Country (*Continued*)

ores and taconite, thus assuring an extension of the life of the mining industry in the range communities for many years to come."

Mr. Elstad called attention to the fact that, in the great Hull-Rust open pit, the "ribs" of the mine are now showing and the mine is nearing its end. He said that the schedule for 1948 called for a larger production from the Hibbing-Chisholm district than was shipped in 1947. Plans include the opening of new properties in the district such as the Pillsbury, Monroe, and South Frazer mines. The last is to be called the Sherman mine in honor of H. S. Sherman, retired general superintendent of the district. Additional equipment required includes locomotives, dump cars, cranes, shovels, trucks, tractors and shop and repair facilities. Crushing and screening plants and new beneficiation plants to be located at various points on the Mesabi are planned, including a nodulizing and sintering plant. Plans for the last will be announced soon.

As an example of the company's plans to develop further underground iron-ore properties, Mr. Elstad cited the new headframe at the Frazer mine, which, with shaft, engine house and change house, will cost about $900,000.

In accord with the company's policy of conserving iron-ore resources, the development of underground mines is underway. The company has underground reserves in the Hibbing-Chisholm district of considerable size. This program will provide stabilized employment for years to come. Underground mining has declined in the past decade because of high labor costs and the shortage of trained underground men. Mr. Elstad said that, if no interruptions occur, the tonnages shipped should set a new peacetime record.

Mr. Elstad told his audience that the Oliver company's aim is to be a good citizen of the communities in which it operates, to work harmoniously with other range citizens to secure maximum benefits for all. He assured his listeners that the company intends to conduct its affairs on the Mesabi range in a way to merit continued confidence.

★Plans have been announced for increasing production of peat at the plant near Floodwood (some miles west of Duluth) by installing a dragline. Odin A. Sundness, general manager of the Snyder Mining Co., is one of the state's most enthusiastic advocates of peat development.

★Oliver Iron Mining Co. has begun stripping work at its Canton mine at Biwabik, on the eastern Mesabi.

★Plans are being made by the Duluth Industrial Committee and the University of Minnesota Extension Division for three labor relations meetings, these to be held in Duluth.

★A fire at Pickands, Mather & Co.'s Mahnomen mine, near Ironton, on the Cuyuna range, Jan. 25, destroyed part of the main mine building, housing the ore-grading and engineering departments. Loss is put at about $25,000.

★Michael P. Walle, ore beneficiation research engineer with Cleveland-Cliffs Iron Co., Hibbing, talked on titaniferous iron ores at a meeting of District Eight Association of Professional Engineers at Virginia, Jan. 24.

★Optimistic statements made some time ago about Lake Superior iron ore reserves by Wilfred Sykes, president of Inland Steel Co., were recently brought to the attention of the Minnesota State Tax Commissioner, G. Howard Spaeth, at St. Paul, by the board of St. Louis County, Minnesota, in which most of the Mesabi Range is situated. The board called particular attention to the following statement: "Under the present taxation laws, if you find a body of ore, you immediately have to pay taxes on it, so we are not so very anxious to go out and drill a hole in the ground and find a nice new mine unless we have need for a mine. If we do so, we may be paying taxes for the next 25 or 30 years before we get down to using it. There are large areas which have not been explored, and in which we are pretty certain there are large bodies of ore, but we don't want to find them

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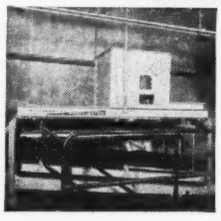

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under present tax conditions." Instead of taking this paragraph as a reflection on present taxation methods that retard exploration, the board considered it as an admission of tax evasion.

★At a meeting of the International Shipmasters' Association in Buffalo Jan. 27, Capt. Henry F. Wiersch told the 200 lake skippers attending the four-day meeting that 1948 shipments of ore on the Great Lakes would exceed the peacetime record of 84 million tons.

★Unwatering of the Champion mine, Beacon, Mich., by North Range Mining Co., started in January after Cliffs Power and Light Co. had built a nine-mile transmission line to it. A 3,000-gpm. centrifugal pump is being used in the most westerly of the five shafts, which is 2,200 ft. deep. A 14-in. steel pipeline carries the water away. Water was lowered 40 ft. by February 1. North of the shaft, a 40x180-ft. Quonset hut is almost completed. It is lined with ¾-in. Celotex sheathing for insulation. The first 40 ft. of the building is finished for office and warehouse. The center section is to be engine house. A concrete foundation for an electric compressor has been completed and a heating boiler is being installed. In the west end will be the change house and shops. R. S. Archibald is manager of North Range.

★According to A. D. Chisholm, general manager, Pickands, Mather & Co., Duluth, H. J. Richards has been made general superintendent of mines on the Menominee range.

★Starting January 1, W. R. Atkins, formerly superintendent of the Negaunee mine of Cleveland-Cliffs Iron Co., was transferred to the Cambria Jackson mine; Curtis Sundeen, for several years superintendent of the Athens, was moved to the Negaunee, and John Trosvig, superintendent of the Cambria Jackson mine since it was taken over from Republic Steel several years ago, was transferred to the Athens as superintendent.

★Unwatering the Bristol mine at Crystal Falls, Mich., by Inland Steel Co. is now underway and a 2,500-gpm. deep-well pump, set for 360-ft. depth, has been installed in the shaft. While the latter is 900 ft. deep, most of the water is near surface and can be removed with this pump. Men from the Sherwood mine at Iron River are doing the work. Phillip D. Pearson is superintendent.

SOUTH DAKOTA

★Production of gold and silver from South Dakota mines in 1947 increased 30% over that produced in 1946. Preliminary estimate for the year is $14,325,000, which ranked third in gold production for the United States. Utah was first with 413,000 oz., Cali-

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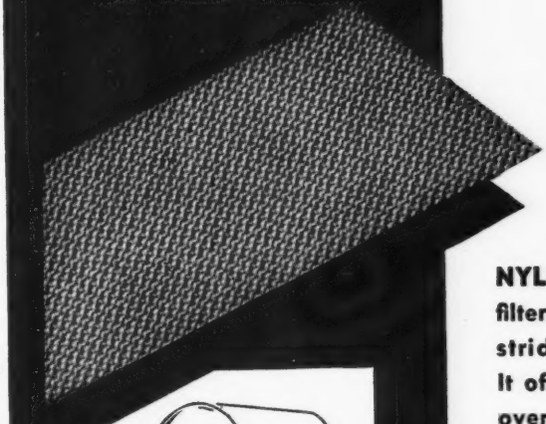

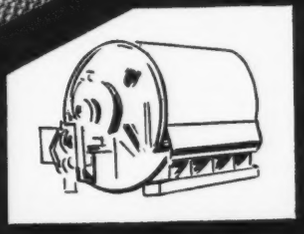

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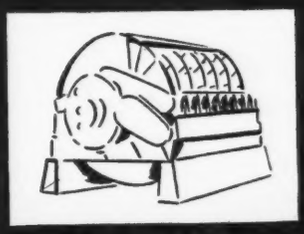

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South Dakota *(Continued)*

fornia second with 410,760 oz., and South Dakota third with 406,365 oz. Output of the two largest companies was limited by a shortage of underground workers.

★Bentonite pits and pegmatite mines operated at the same rate as in 1946. The new bentonite plant of the Baroid Company, northwest of Belle Fourche, was started in January. It is planned to operate it at 60% capacity until completion.

★The Longyear company has a contract with the U. S. G.S. to diamond-drill pegmatite deposits near Custer. At present, drilling of a pegmatite deposit west of Custer is in progress. Dr. Lincoln Paige is in charge of the survey's field office at Custer.

★The Black Hills Tin Co. produced feldspar from their property at Tinton, in 1947, and plan on stepping up production in 1948.

MICHIGAN

E. R. Lovell describes Calumet & Hecla's efforts to build more stable industry in Copper Country

★Calumet & Hecla Consolidated Copper Co., through a subsidiary, the Calumet Corporation, and other companies are conducting exploratory work in the Wisconsin-Illinois zinc-lead district. About 60 drills are in use and altogether about 1 million dollars per year is being spent by the companies, which include some major producers of zinc and lead. Among the companies so engaged are the Tristate Mining Co.; Eagle-Picher Mining & Smelting Co.; Vinegar Hill Zinc Co., a pioneer in the district; St. Joseph Lead Co.; American Metal Co. and the Inland Lead & Zinc Co. Some of these are said to have had success in finding new deposits or in extending known ones.

Calumet & Hecla is running nine drills south of Shullburg, Wis. Results are encouraging. The management feels that development has not gone far enough to make a definite announcement. Explorations to date have shown enough holes in ore to indicate strongly that one or more orebodies are to be found in the property under lease. Exploration is being pushed vigorously and it is possible that a tonnage may be developed equalling or exceeding that of the recently discovered orebodies of the Tristate and Eagle-Picher companies.

★Two more diesel locomotives have been ordered by Calumet & Hecla from Baldwin Locomotive Works. They are of the six-cylinder type, weigh 120 tons, and are rated at 1,000 hp. Delivery is expected in July. They will be used two shifts a day. A 70-ton, 600-hp. G.E. diesel locomotive is operating at the mill property. Another G.E. diesel, of 45-ton class, is being used in and around the smelter at Hubbell. A 40-ton universal-service diesel-electric crane is also on order. It will be used mainly in the secondary copper department at Hubbell.

★Speaking before a meeting of the Calumet and Laurium Chambers of Commerce recently, E. R. Lovell, president of Calumet & Hecla, pointed out some achievements of the company, since 1941, in its efforts to build a more stable industry. Some of these included the purchase of the Wolverine Tube division in Detroit, an investment which has paid for itself and is a profitable enterprise; the development of new shafts, of which there are seven at present as compared with three in 1941; the establishment of a secondary copper industry at Lake Linden; the opening of the Lake Chemical plant; the production of castings for use outside the district by other concerns; the production of underground rock-drill bits which are being marketed elsewhere; research in agriculture for the use of copper oxide; zinc-lead ore drilling in Wisconsin, and the organization of the Market Research department of the company, the purpose of which is to find new uses for C.&H. products.

The most profitable of these efforts in the Calumet division, according to Mr. Lovell, is the secondary copper enterprise, a full account of which will be given in the company's report in March.

Investments have been made in the Calumet division for the erection of a new power plant, new equipment on the company's railroads, the re-opening of Seneca No. 2 shaft, and improvements in the smelter and mills. With gradual increases in wages and other production costs, however, the company is losing money on its underground operations, according to Mr. Lovell. With new equipment, labor saving devices, etc., it is hoped to get back in the black. Efforts also are being made by the copper industry to establish a new premium price plan.

NORTH CAROLINA

Thirteen mica corporations penalized for anti-trust act violation

★Thirteen mica mining corporations in North Carolina charged with violating the Sherman Anti-Trust Act were fined a total of $14,500 on January 9 in ending a suit brought against the corporations and 13 individuals. Charges against the latter were dropped. Fines ranged from $250 to $2,000 for individual corporations.

The Federal grand jury had returned two indictments charging the

companies and their officials with having "engaged in a wrongful and unlawful conspiracy to fix the terms, conditions and manner" in which mica was produced and sold. It was charged that they controlled 85% of the domestic production of sheet mica, about 65% of that of fabricated mica, and between 90% and 95% of the output of wet-ground mica.

ALASKA

Cost of air transport has decreased while other costs have risen. Gold dredging trends upward

★James Crawford, dredge superintendent for U. S. Smelting company, which at peak operation employs about 900 men, told the Lions Club at Fairbanks recently that within three years the company's eight electric dredges will be operating. They are of the bucket type with tailings stackers.

★Alaska Miners Association, meeting at the Arctic Club, Seattle, in January, discussed the Governorship of the Territory, the plight of the University of Alaska, and the condition of Alaska's finances. At a directors' meeting earlier, J. K. Crowdy, of New York-Alaska Gold Dredging Co., was elected president of the Association, and the following vice presidents were chosen: F. K. Dent, of Council Dredging Co.; H. L. Faulkner, Juneau attorney; C. F. Herbert, of Candle Creek Dredging Co. and Al Renshaw, of Gold Cord Co. New directors for the Association are Glen Carrington, W. A. Castleton, J. K. Crowdy, J. Dodson, W. E. Dunkle, Roy B. Earling, H. L. Faulkner, L. McGee, G. Hellerich, L. Hess, C. J. Johnston, A. E. Lathrop, A. Mathieson, A. Olson, E. N. Patty, C. Poulson, J. Repo, Norman Stines, H. Strandberg, G. Uotila, H. Waechter, F. Whaley, J. A. Williams and R. E. Wyer.

★Harold Strandberg, mine operator, said in Anchorage recently, "We are now at the low point of our depression. Little prospecting has been done since the war, and not much equipment has been brought in." He said "Prospecting will expand in the future. Business men would do well to consider investing some money in these ventures." He called attention to a decrease in the cost of air transportation, while seemingly everything else was rising.

☆Mines of Alaska have yielded mineral valued at 900 million dollars. Gold has accounted for 630 million dollars of this amount, copper 230 million dollars, and tungsten, lead, silver, chromium, antimony, quicksilver, tin, platinum, and some non-metals 40 million dollars. The Geological Survey and the Army Air Forces have made maps of large untouched areas.

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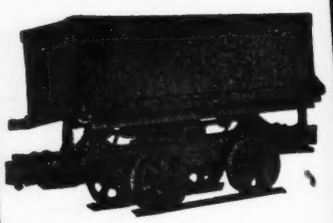

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CANADA

Phosphate industry seen for eastern Canada—Sherritt Gordon strike decision reached—Vananda liquidates

★"Economic fusion" between Canada and the United States was indicated by the special trade agreement between the two countries directed toward removal of tariffs in broad areas, according to the terms of the Export-Import Bank loan of 300 million dollars to Canada last December. Provision was made for managing Canadian production so as to supplement that of the United States in such a way that no interference would result in the immediate needs of the European Recovery Program. Canada would give special attention to supplementing United States shortages in minerals, agriculture and manufacturing. The trade agreement would have particular bearing on supplies of copper and lead.

★Recognition was given in December, 1947, to the demand in Eastern Canada for a domestic source of phosphates, which are now imported from Florida. The Atlantic Chemicals Co., Ltd., announced that a 120-acre site had been secured in Albert County, New Brunswick, where a plant is to be erected to make superphosphate, sulphuric acid, and Portland cement, at a cost estimated at 4 million dollars. This move was stated to be the forerunner of an integrated chemical industry for southern New Brunswick. It is similar to plans for a fertilizer plant to be located near St. Charles, Quebec, in the Saguenay district.

★Wages in various branches of the mining industry for the week of Nov. 1, 1947, showed little change as compared with the previous month but were considerably higher than in any previous year. Wage earners in mining increased 1,192 to a total of 79,270 at November 1, according to the Dominion Bureau of Statistics, while the average hours per man dropped from 43.5 to 42.8 for the week compared with 43.2 for the same week of 1946. The index of employment in the mining group at November 1 was 167.8, an increase of 7.2 percent over the same date in 1946. In the same period the index of payrolls went up 18.7 percent. Per capita earnings moved up from $40.22 to $44.77 in the year.

QUEBEC

★The world's largest aluminum smelter, located at Arvida, is supported by the greatest installed capacity of any power plant in the world, at Shipshaw. The rapid industrialization of Quebec has been due largely to hydro-electric development along the St. Lawrence River and tributary streams. Quebec hydro has a higher per capita development than elsewhere in the world, with power available at a lower average cost per kilowatt-hour than from any other source on this continent.

Aluminum ranks second only to iron and steel in the volume of output and has become a unique contribution to the growth of Quebec and the Dominion as a whole. More than one-fifth of the world's aluminum ingot tonnage is produced at Arvida by the Aluminum Co. of Canada, utilizing Canadian labor and waterpower. Canadian aluminum is sold in every country in the world and the industry at Arvida has made a major contribution to Canada's economy and to world trade and reconstruction.

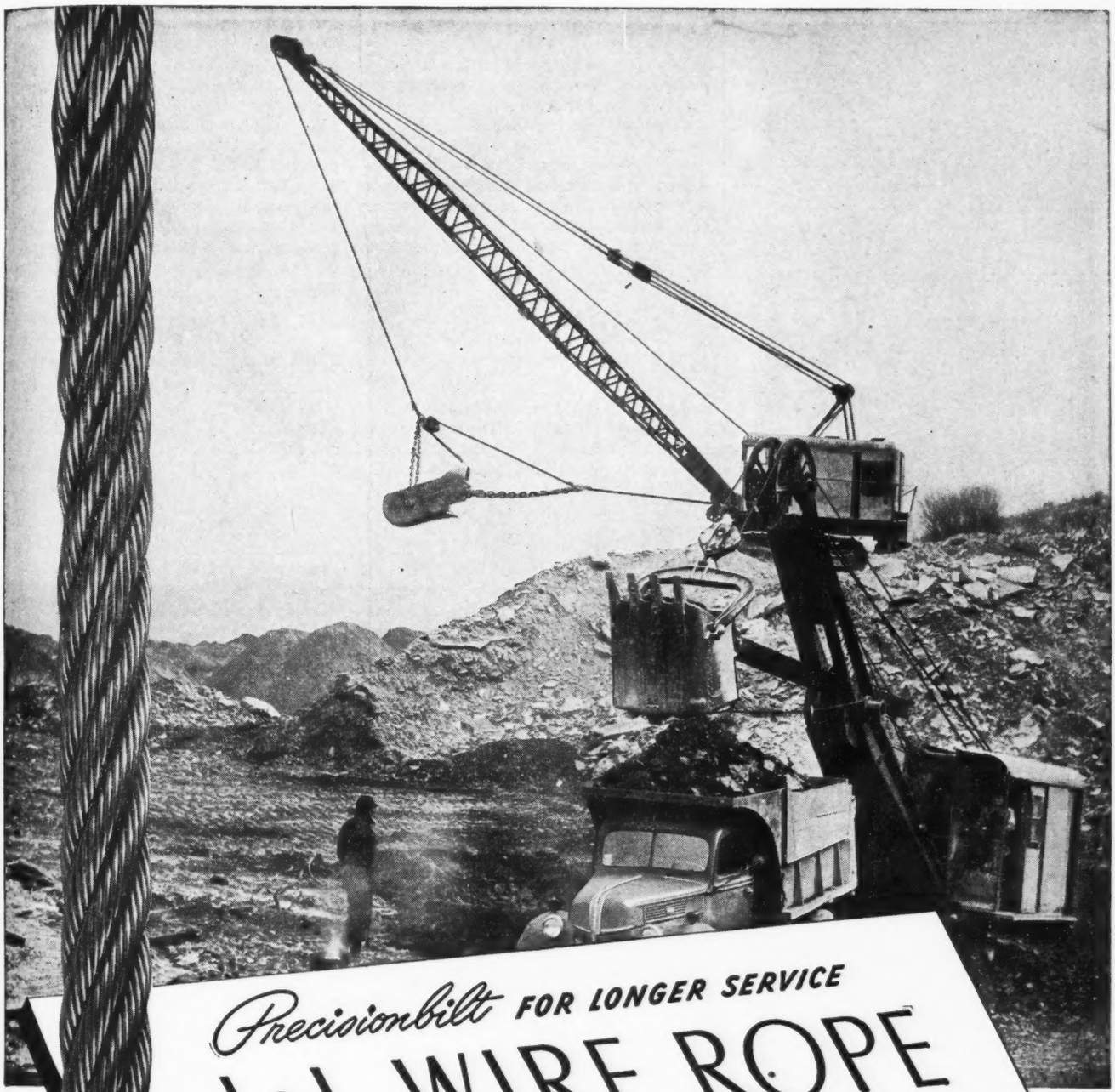
Aluminum produced in 1946 was valued at $138,619,524 and other metals produced in Quebec were valued at $40,318,934 in 1946, when nonmetallics amounted to $27,955,730 and building materials $21,458,358. Asbestos, for the first time in 30 years, was first in importance in Quebec mining, with a value of $24,490,695, followed by gold valued at $21,543,989.

★Promising results in 1947 were reported from exploration in various areas. These include lead deposits near Lake Mistassini; hematite in Ungava north of the Labrador boundary, and north of Comeau Bay; titaniferous magnetite near Havre St. Pierre and near Arvida; and gold-silver deposits in the Bachelor Lake area. A railroad from Barraute 55 miles northeast to Kiask Falls, to be completed next summer, will reach within 165 miles of the Chibougamau district; this is scheduled to be connected this year by highway with the railroad at Lake St. John.

★The Quebec Department of Mines announced that gold recovery in the first eleven months of 1947 amounted to 559,118 oz. (574,253 in the same period of 1946); silver, 1,654,400 oz. (1,864,953); asbestos, 603,816 tons (508,381); cement, 5,125,246 bbl. (4,835,904); clay products, $3,861,655 ($3,189,824); and lime, 315,025 tons (270,587).

★At Thetford Mines, six asbestos pits were affected in January by a strike of 2,000 employees of the Asbestos Corporation and the Johnson's Company, as a protest against the delay in concluding negotiations for a new collective labor agreement. It was proposed to send a conciliator from the Labor Department to conduct negotiations for a new contract. The labor syndicate made four demands: adjustments in the wage scale; two weeks' holiday with pay; negotiations between union and company regarding promotions and transfers; and adoption of the Rand formula for the compulsory check-off of union dues, whether or not the workers are union members. The company proposed to set up a joint grievance committee to hear workers' complaints.

★East Sullivan Mines in January reached an agreement with Noranda



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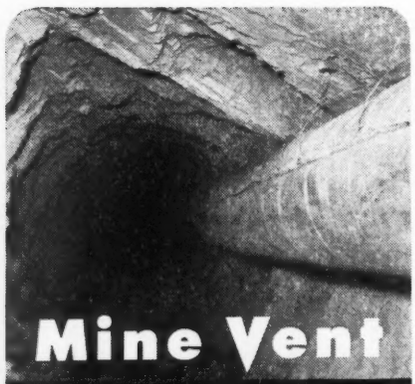

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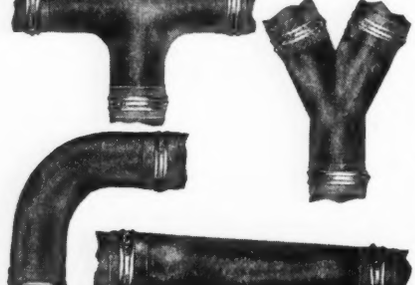

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Quebec (*Continued*)

Mines for smelting, refining, and marketing the East Sullivan ore. Funds sufficient to bring the new mine into production are to be supplied by Noranda through a 2-million-dollar bond issue carrying 5% interest. About six months after production starts the bonds will be repaid at the rate of 50c. per ton. An option, that may be applied against repayment of the bonds, is to be granted Noranda on 200,000 East Sullivan shares at $4 per share, plus 50,000 shares as a bonus.

ONTARIO

★Output of gold mines in the province for the first eleven months of 1947 was valued at $61,292,358 from 7,008,908 tons milled, compared with 6,620,590 tons in the same period of 1946, valued at $59,958,448. Metal recovery in the 1947 period was 1,745,209 oz. gold and 265,047 oz. silver. Production in November was reported by 44 mines, the grade averaging $8.80 per ton. The number of employees was 12,243, the highest since August, 1947.

★D. L. H. Forbes, president of Teck-Hughes Gold Mines, reported production in 1947 was $1,049,383 from 71,360 tons, compared with $1,093,863 from 91,302 tons in 1946. Positive ore reserves at 250,247 tons dropped 5% below the figure at the end of 1946. Considerable reconditioning and lateral development in waste rock remained to be done before the new ore being developed corresponded with ore extracted from the mine. George C. Gilchrist is manager.

★On the Michipicoten iron range, substantial development work is in progress at the Helen and Victoria mines of the Algoma Ore Properties, controlled by Algoma Steel Corporation, Sault Ste. Marie. Algoma Steel, with 10 million dollars working capital and plant capacity of more than 1 million tons of steel annually, reported net profit of $1,255,531 for the last fiscal year. Plans have been announced for increasing production at the Helen mine to more than 5,000 tons of raw siderite ore daily and to more than 3,000 tons of finished sinter, with operations on a year-round basis. Open cut operations are being converted to underground mining on two levels that are in the course of preparation. The adjoining Helen and Victoria mines are located ten miles southwest of the Britannia property, where capital expenditures for production equipment are now proposed. The Britannia ore is reported to be higher grade and suitable for mixing with the Helen and Victoria ores. Higher grade is also typical of the magnetite in the Goulais range, located 60 miles north of the Sault and about 75 miles south of Michipicoten. Exploratory work in the war years at a cost of $500,000 resulted in estimating 150 million tons to a depth of 1,500 ft. along a 4.5 mile zone. Ore tests of carload shipments indicated a 64% concentrate as practical. Present plans call for mining about 2,500,000 tons a year, pending results of the Minnesota test plants for treating taconite ores. The taconite averages 24%, compared with better than 30% recoverable magnetic iron for the Goulais ores. Sir James Dunn is president of Algoma Ore Properties and George W. MacLeod is general manager.

MANITOBA

★The preliminary estimate of the mineral production of Manitoba, compiled by the Dominion Bureau of Statistics, for 1947 reveals an aggregate value of $17,289,315, as compared with $16,403,549 in 1946. Of the 1947 total, metals accounted for $11,726,336 and industrial minerals for $5,562,979. The following break-down gives the production and value by products, with the corresponding figures for 1946 in parentheses. Metals: Gold, 71,861 oz. valued at $2,515,135 (79,402 oz., $2,918,024); silver, 358,473 oz. valued at $258,101 (528,017 oz., $441,686); copper, 29,600,000 lb. valued at $6,035,440 (38,501,047 lb., $4,928,134); zinc, 24,800,000 lb. valued at $2,785,400 (35,580,537 lb., $2,778,840); cadmium, 46,500 lb. valued at $79,980 (63,410 lb., $77,360); selenium, 24,500 lb. valued at $45,815 (46,118 lb., $83,935); tellurium, 3,900 lb. valued at $6,825 (349 lb., $537).

It will be noted that although the value of metals produced is appreciably higher than the previous year, the quantity of all principal metals shows a decline as compared with 1946. The major factor in the decline of metallic production was the reduced tonnage milled at the Sherritt Gordon mine. This was due in part to the closing of the East mine and in part to the strike which lasted for over three months.

★During the past year 6,732 mining claims were recorded in Manitoba, as compared with 3,318 in 1946. This is the largest number of recordings since the transfer of the natural resources to the province in 1930. There were 12,229 mining claims and 2,580 leased claims in good standing at the year's end, as compared with 8,997 claims and 2,458 leases in 1946.

★The contemplated expansion of the hydro-electric power plant at Island Falls, during 1948, by Hudson Bay Mining and Smelting Co., Ltd., is dependent upon delivery of turbines and generators in February. This equipment must be received before the end of the winter freighting season. Shaft sinking at the company's Schist Lake property, southeast of the parent mine, has passed the first level and development is proceeding. At the Cuprus mine, in which Hudson Bay holds a majority interest, foundations have been completed for the concen-

trator, and steel frame construction is underway. It is anticipated that production will start before the end of the year. Daily tonnage is expected to be 300 tons; copper and zinc grades are somewhat higher than the main mine. The company has granted its employees a cost-of-living bonus of 10c. per hour retroactive to January 1. Half of the bonus, at the employees' request, will be paid in Government Savings Bonds. The bonus is subject to review at the end of June.

★It was revealed, at the annual meeting of Northern Canada Mines, Ltd., that the amalgamation of 66 claims at and south of the western end of Snow Lake has been started, including 46 claims held by the company and Pioneer Gold Mines of B.C. Limited. This contiguous block of claims adjoins the Howe Sound Exploration Co.'s Nor-Acme property on the southwest. The merging of the groups is essential to the exploration of a structure crossing four properties.

★Mill construction at Ogama-Rockland Gold Mines, Ltd., is progressing more rapidly than anticipated; milling is now expected to commence during May. Development work on the 500-ft. level has advanced drifting 314 ft. east, revealing short lenses of ore grade. However, erratic values make it doubtful if this section can be classed as ore. The west drift, on the same level, has advanced 237 ft., yielding sections of ore grade over a 135-ft. length. Values in this section are also irregular. On the 625-ft. level an east drift has 257 ft. revealing an ore shoot 115 ft. in length averaging 0.317 oz. gold per ton across a width of 4 ft. At the 750-ft. level a west drift in an advance of 112 ft. has opened a short section of ore. An east drift advanced 141 ft. has encountered ore which is apparently a downward-extension of the ore encountered on the upper levels. Surface diamond-drilling southwest of the shaft has revealed an oreshoot 200 ft. long carrying good values over drift widths. A parallel vein, carrying ore values, has been discovered to the south. A second shaft to investigate this vein system is planned for the coming summer.

★During January the staff of San Antonio was augmented by the addition of 20 European displaced persons. The company expects to acquire an additional 80 employees from this source to alleviate an acute labor shortage. The company contracts to employ these men for at least ten months, but the employee has the privilege of leaving at any time.

★The Board of Arbitration established in connection with the Sherritt Gordon mine strike reached the following decisions: (1) That the 14c. per hour increase granted be retroactive to July 1st; (2) That a check-off be established, but that non-union members be assessed half fees; (3) Suspension of the check-off should the union call, or fail to repudiate a strike, without a secret ballot; (4) Any employee participating in an illegal strike be liable to a fine of $3 per day. Production of approximately 1,500,000 pounds of copper in December indicates that mine operations are now proceeding at a normal rate. At Lynn Lake diamond-drilling is proceeding, the headframe at the "A" orebody has been erected, and preparations are underway for sinking on the "EL" orebody.

★Operations have been suspended at the Ferro property on Herb Lake by Wekusko Consolidated, Ltd. The company is awaiting completion of present financial arrangements and a solution of the problem of power supply. Officials consider that developments of the last 18 months have indicated sufficient ore to justify the installation of a 100-ton mill.

A new company, Valrex Gold Mines, Ltd., has been formed to assume the assets and liabilities of Kiwago Gold Mines, Ltd. Underground operations at the Kiwago property were suspended late in 1946.

SASKATCHEWAN

★On January 23 the Canadian Pacific Railway Co. and four smaller railways filed a writ in Regina claiming that the Saskatchewan Mineral Taxation Act was *ultra vires* in respect to the acreage tax imposed. The Act, which imposes a tax of three cents per acre on all underground mineral rights, was declared unconstitutional, as it was an attempt by a provincial government to impose direct taxation contrary to the provisions of the British North America Act.

★Newcor Mining and Refining, Ltd., have suspended smelter operations at their arsenic-gold property southwest of Flin Flon, Manitoba. A shortage of coke is given as the reason for the shutdown. Underground and concentrator operations will continue.

BRITISH COLUMBIA

★Liquidation of Vananda Mining Co., Ltd., operating a gold-copper prospect on Texada Island, B.C., and formation of a new company, Vananda Mines (1948), Ltd., was approved by shareholders at an extraordinary general meeting last month. Pioneer Gold Mines of B.C., Ltd., has expended an estimated $300,000 on the development of the Vananda property, and will receive 937,500 shares in the new company in full payment of all expenditures after surrendering 750,000 shares of the old company. Sheep Creek Gold Mines, Ltd., another well-known British Columbia mining company, will purchase 937,500 shares in Vananda Mines (1948), Ltd., for $250,000 and has agreed to advance a loan of $50,000 repayable out of first production if required. Present shareholders of Vananda Mining Company, Ltd., will receive one share in the new

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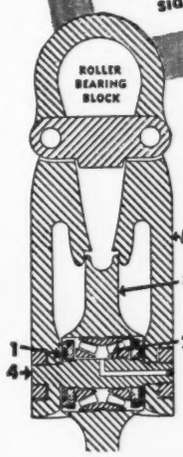

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British Columbia *(Continued)*

company for each two old shares surrendered. Funds advanced by Pioneer Gold Mines under the original agreement proved inadequate due to higher costs and more extensive development requirements than had been anticipated. Direction of Vananda Mines (1948), Ltd., will be assumed by Henry E. Doelle, managing director of the Sheep Creek Company.

★M. M. O'Brien, president of Taylor (Bridge River) Mines, Ltd., has advised shareholders that the long exploration crosscut being driven by Bralorne Mines, Ltd., from the latter company's 20-level is now being advanced at the rate of 7 to 8 ft. per day. Bralorne took over control of the adjoining Taylor (Bridge River) property under an agreement whereby the Bralorne company would acquire operating control and would test the Taylor (Bridge River) ground.

★Shareholders of The Twin "J" Mines, Ltd., owner of a presently idle copper-zinc-gold producer on Vancouver Island, have approved a complete reorganization as recommended by directors. The plan as submitted calls for sale of the company's entire assets to a new company to be incorporated in California, or alternatively in British Columbia. The operation was revived in 1947 and ran for about six months, but was handicapped by insufficient experienced labor and was unable to make a profit.

★Giant Mines and Metals, Ltd., a newly incorporated company, has acquired title to the former Ashloo property near Squamish, B.C. A contract has been let for 200 ft. of exploration tunneling.

★Exploration at the Bridge River district property of B.R.X. (1935), Ltd., has revealed a silicified porphyritic body on the 8-level near the California vein. True width is estimated at 60 ft., of which a 20-ft. section near the footwall carried values averaging $6 a ton. Grade in the center of the body was lower, but material of near ore-grade was found also on the hanging wall side. Drifting will be continued on the California vein to a point where a diamond drill station can be cut.

★A decided improvement in labor supply during the last quarter of 1947 was reflected in increased production at the Bridge River district property of Bralorne Mines, Ltd., and it is expected that if this favorable condition continues, mill capacity will be reached within a few months. Production during the last three months of the year was 17,910 oz. gold valued at $626,850 from 38,634 tons of ore milled. Total output for the year was 60,253 oz. from 133,047 tons for a total value of $2,108,855, establishing Bralorne's position as British Columbia's leading gold producer for the twelfth successive year. Work is progressing rapidly on the company's Yalakom district property, where a long tunnel is

being advanced to intersect at depth veins which showed good values on the surface. It is expected that the first intersection will be obtained within the next few weeks.

★W. B. Milner, president of Taku River Gold Mines, Ltd., has advised shareholders that development of the company's Polaris-Taku mine is proceeding satisfactorily. During 1947 production was 26,842 oz. gold from 89,793 tons of ore averaging 0.334 oz. per ton for a gross value of $939,461. The Polaris-Taku mine now ranks third, exceeded only by Bralorne and Kelowna Exploration Co.'s Nickel Plate mine, in annual gold production in British Columbia.

★Construction of a 300-ton cyanide plant at the Alice Arm property of Torbrit Silver Mines, Ltd., will be started as soon as weather conditions permit. The Torbrit mine is being financed to production by The Mining Corporation of Canada, Ltd. Work done to date has indicated an orebody containing about 430,000 tons averaging 19.3 oz. silver per ton, after allowance for dilution.

★A 50-ton mill has been ordered by Silver Standard Mines, Ltd., for early installation at the company's silver-lead-zinc mine at Hazleton, B.C. Mill construction will permit an increase to 75 tons daily by addition of a secondary crusher and additional flotation cells. Ridgeway W. Wilson, managing director, reports estimated ore reserves at 40,918 tons averaging $42.20 per ton gross value, equally divided between proven and probable ore. He states this ore should provide a net profit of $16.40 per ton, or $673,000 under present conditions.

★Development work to date at the Alpine Mining Co.'s property in the Nelson district has indicated ore reserves of 100,000 tons, justifying an increase in production, John B. White, president, has advised shareholders. The Alpine mine is milling at 40 tons per day, but the rate will be increased to 75 tons per day as soon as a new crusher and classifier are installed.

★Yukon Consolidated Gold Corporation, Ltd., largest gold dredge operating company in Canada, produced approximately $1,330,000 during 1947, slightly less than the output recorded for the previous year. During the year, the company operated six dredges in Yukon Territory. More labor was available than during the past few years, and it was possible to pay greater attention to stripping and thawing of reserves. As a result, the company plans to put Dredge No. 6, on lower Sulphur Creek, into operation this year. Dredge No. 9, on upper Sulphur Creek, will not be operated until 1949, as a considerable amount of preparatory work remains to be done there.

★North American Goldfields, Ltd., plans to have a 5,000-cu. yd. Lima shovel in operation at the company's

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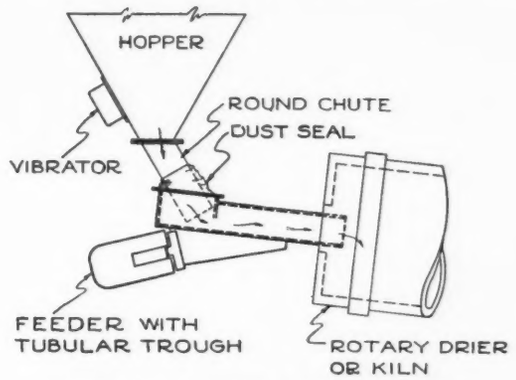

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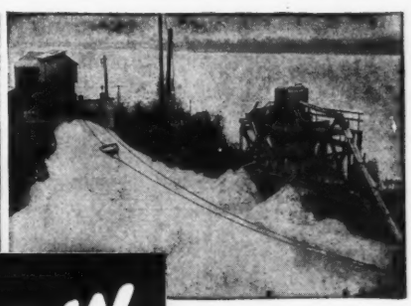

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McGRAW-HILL PUBLICATIONS

British Columbia (*Continued*)

placer property, the French Flat lease, near Quesnel, B.C., by May of this year. Financing of the new equipment has been made possible through participation of American Goldfields, Inc., an Oregon company. The shovel and washing boat will work on estimated reserves of 3,000,000 cu. yds. of tested gravel averaging 20c. to 25c. per yd. and 300,000 cu. yds. averaging 80c. per yd.

★Full exploration rights on the Copperado claims of Guichon Mine, Ltd., in the Nicola mining division have been granted to Frontenac Exploration and Development Co., Ltd., of New Toronto. The Frontenac company is a wholly-owned subsidiary of Anaconda Copper Mining Co.

★Kelowna Exploration Co., Ltd., operating the famous Nickel Plate mine at Hedley, B.C., reports production of 36,589 oz. gold in 1947 from 102,597 tons of ore averaging 0.356 oz. gold per ton, for a gross value of $1,280,615.

AUSTRALIA

Government builds staff to hunt for uranium—North Kalgurli in good position—Mt. Morgan reports profit

★A Commonwealth-wide search for radioactive substances and other mineral resources is being organized by the Bureau of Mineral Resources, Geology and Geophysics of the Department of Supply and Shipping, Canberra, A.C.T. The activities, which will be extended to the Australian part of New Guinea, are under the direction of Dr. H. G. Raggatt. A large staff of geologists, geophysicists, chemists, and draftsmen is being assembled. Positions advertised in the Commonwealth Gazette carry a total of $170,000 in salaries. Magnetic, gravity, seismic, electrical and radioactive methods will be employed.

WESTERN AUSTRALIA

★Several mines which remained idle in 1947 are preparing to resume operations. Shares of New Coolgardie Gold Mines, an offshoot of Western Mining Corporation, were oversubscribed. New Coolgardie proposes to extract gold from small but high-grade shoots on the Barbara and Surprise leases on Block 59, Hampton Plains, totaling 76,000 tons of 13.8 dwt. Monthly crushings of 3,000 tons from this source may be doubled by working an additional lease in the Burbanks Group, near Coolgardie.

Additional gold mining areas have been pegged at the north and south ends of the Kalgoorlie field by Broken Hill and Gold Mines of Kalgoorlie.

One of the fabulous iron islands in the Yampi Sound, 85 miles north of Derby, has again become the object of international concession bargains. While Australian Iron and Steel, of the Broken Hill combine, will shortly set off the first blast on Cockatoo Island, negotiations are still in progress with H. Brassert & Co., of London, for working the Koolan Island leases. Originally granted to a syndicate comprising Brassert and Nippon Kogyo K. K., the leases lapsed when Canberra overruled the state government and placed an embargo on shipments of iron ore. The Koolan ore was, of course, to go to Japan. This time the negotiations are conditioned by the State Government's own desire to make up to 1 million tons a year available to Western Australia's new iron and steel industry, and to keep suspicious capital away from the lone northwestern coastline.

It insists that the ore must not be exported outside the Empire, except to the United States, and that Brassert is not to raise capital in countries which do not qualify as purchasers of the ore. Moreover, the lease may not be transferred without the State Government's consent.

Since overseas markets other than Japan are ruled out by freight considerations, Brassert must develop one of three potential outlets in the Commonwealth. (1) Western Australia, with a present smelting capacity of only 20,000 tons; (2) New South Wales, in case blast-furnace capacity should outstrip ore supplies from Broken Hill's workings in South Australia and on Cockatoo Island; and (3) Queensland, where the Labor government has long been anxious to establish an iron and steel industry at Bowen. The coking qualities of Queensland coal are still a problem but Queensland coal is 800 miles closer than Newcastle.

VICTORIA

★Acting on a British offer to give highest priority to Dominion gold producers in deliveries of mining machinery, the State Government has drawn up plans to restore the industry to its prewar level. Under an agreement operating since September 4, 1947, the Commonwealth's current gold production is sold to the United Kingdom.

Where financial assistance is required for mining operations, money will be advanced by the State to approved applicants free of interest charges. To assist prospectors, it is proposed that the present system of crushing ore at low cost at State batteries should be extended by the use of a modern portable crushing plant. Arrangements are in hand for construction of a trial unit which will probably be the first of its kind in Australia, and if its operation proves as successful as is anticipated, additional crushers will be obtained later.

Every effort will be made to import a portable drilling plant from the

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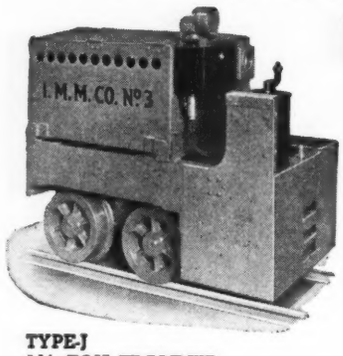

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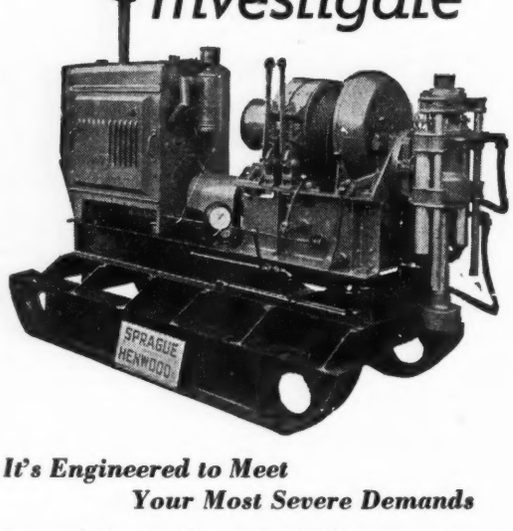

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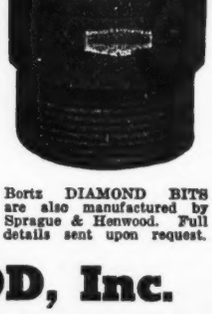

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Victoria (*Continued*)

United States or Canada which will be used for the testing of new areas, mainly for coal, but also for other minerals. The geology of the area in which bauxite occurs is being investigated in preparation for the erection of an aluminum plant in Tasmania.

WESTERN AUSTRALIA

★North Kalgurli (1912) Ltd., on the Kalgoorlie goldfield, is one of the most important companies in the State, and operates a mine with a very satisfactory future. The report of operations for the year ended January 7, 1947, shows a total ore reserve of 1,548,385 tons with an average assay value of 6.02 dwt. gold per long ton; the reserves are made up of 1,116,915 tons of positive ore assaying 6.21 dwt., and 431,470 tons of probable ore assaying 5.54 dwt. per ton. The property was actively developed, and 7,717 ft. of development work completed, of which 34.46% was in ore exceeding 4 dwt. per ton in grade; diamond drilling totaled 6,470 ft. Development has increased ore reserves by 100,000 tons over the previous year, with little alteration in grade. Generally, the orebodies opened up may be considered high grade, many exposures being of ore assaying from 6 to 30 dwt. per ton, over widths up to 21 ft. Ore is treated at the mill of Kalgurli Ore Treatment Co., Ltd., of which the North Kalgurli company is a part owner. Ore treated totaled 129,283 long tons having an average value of 6.557 dwt. per ton, and gold content amounted to 42,386 fine oz. Working costs continued to rise; wood fuel advanced 2s. to 34s. per ton, compared with the pre-war price of 19s. per ton, which has increased the cost of power by 40%. The basic wage has been increased 6s. 4d. per week and the State Arbitration Court has granted employees ten days additional holidays per year on full pay, which affects working costs by 8d. per ton. Nevertheless, the cost position has been well controlled; cost of mining was 13s. 9d. per ton, compared with 12s. 10d. in the previous year, and that of treatment was unchanged at 12s. 10d.; total costs were 35s. 7d. compared with 33s. 6d. per ton. The net price of gold to the producer was £A9-17-7½ per fine oz.

★Western Mining Corporation, Ltd., the large exploratory organization which controls Central Norseman Gold Corporation, N.L., has reported operations for the year to March 18, 1947. Production for the year was 109,924 tons of ore from which were recovered 38,342 fine oz. of gold; the average ore milled per four-weekly period was 8,456 tons, head value was 7.25 dwt., assay value of residues was 0.28 dwt., and recovery was 96%. Ore reserves were estimated at 229,000 tons with an average value of 7 dwt. gold per ton; these figures are exclusive of ore in course of development

in the new ore zone below No. 22 level. The new ore has been followed by a winze to a depth of 451 ft. below No. 22 level, the average value for 337 ft. being 8.6 dwt. per ton; subsequent work along the lode has given similar results. A new main, underlay shaft is to be sunk, 5,750 ft. north of the present main shaft, to work the newly located orebodies. Working costs per ton were: mining, excluding development, 28.55s.; treatment, 8.42s.; total cost, 36.97s. per ton. The mine has a diesel-electric power plant which generated 5,781,630 kwh. at a cost of 0.99d. per unit. Western Mining Corporation has continued prospecting in various parts of the State on an active scale.

Well planned work is directed to bringing the gold mining industry back to normal, and every effort is being made to offset rising costs by improved methods. On the Southern Cross field, 63 leases are under examination. The first stage of the work is by diamond drilling, followed by normal underground exploration when results warrant this course. At Hampton Plains, the company has exercised options over the Barbara and Surprise groups of leases which contain orebodies of considerable importance, exposures of ore over satisfactory dimensions giving values from 8 to 17 dwt. gold per ton.

QUEENSLAND

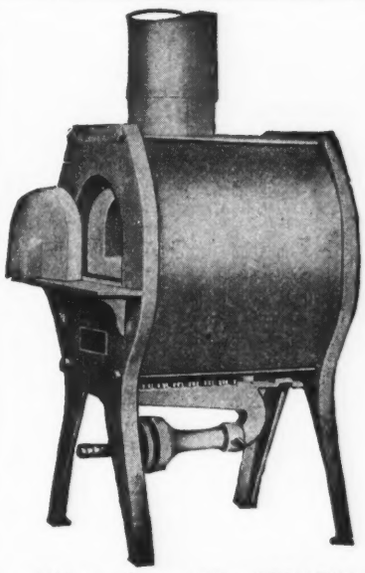
★Mount Morgan, Ltd., the large open cut gold-copper mine west of Rockhampton, reported a profit of £A101,035 for the year ended June 28, 1947. Labor was in better supply, but tradesmen were still scarce. The open cut is being worked to a depth of 650 ft. and preparations are in hand to carry it down to another bench. Total material mined amounted to 1,629,902 long tons, of which 813,475 tons was discarded as waste and 816,427 tons was delivered to the treatment plants. The assay value of the sulphide ore treated averaged 2.44 dwt. gold per ton and 0.45% copper, and of this mill feed, 59.36% was obtained outside the calculated ore reserves. Ore reserves are estimated at: Sulphide ore, 5,743,477 tons; assay value, gold, 4.08 dwt.; copper 1.91%.

Indicated material, 2,520,779 tons; assay value, gold, 1.61 dwt.; copper, 0.46%.

The smelter produced 2,828 tons of blister copper, estimated to contain 2,795 tons of copper, 59,051 oz. gold and 17,408 oz. silver. Operating costs are shown below.

Sulphide ore:	Cost per ton	
Mining	9s.	6.47d.
Treatment	5s.	10.83d.
	15s.	5.30d.
Mining; total material ..	4s.	8.56d.
Smelting; per ton copper		£A34-4-7
Power; per kwh.		0.6086d.

The minimum rate of wages paid



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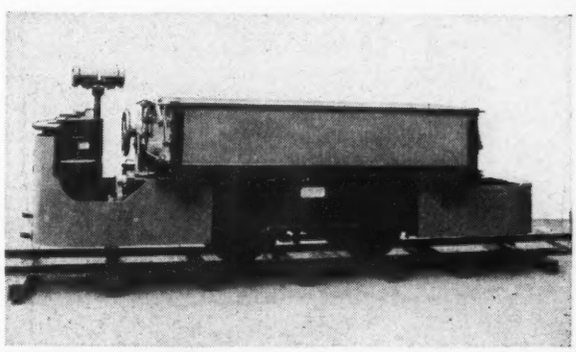

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Queensland (*Continued*)

by the company was £A5-15-4 per week. The basic wage rose 11s. per week in comparison with the previous year and cost of stores has continued to increase. The company has taken up an area of 12 sq. miles contiguous to the Mount Morgan mine for the purpose of exploration by diamond drilling, for concealed orebodies. The Australian price of copper has been raised to £130 per ton, but is still £35 per ton below world parity.

NEW SOUTH WALES

★Broken Hill South. Ltd., Broken Hill, in common with the other companies on the field has had a particularly good year, due to the high prices for lead, zinc and silver, obtained for exported metals, which have amply offset the fixed prices for metal consumed in Australia, which remain unaltered at £A22 per ton for lead and zinc, a limit which is well below the cost of production. The current export price for lead is £A90 to £A100 per ton and the average realized during the year was approximately £A78 per ton. The average overseas realization for zinc was £52 (sterling) per ton, and the fixation of the local price at £A22 had the effect of reducing the company's revenue from this source by approximately £A150,000. The net profit for the year ended June 30 was £A650,180, of which £A500,907 came from mining and the balance from investments. The orebody is gradually shortening at the bottom levels, but it is considered that production can be maintained for a further nine years. Ore reserves are estimated at 1,915,000 tons, exclusive of ore indicated by diamond drilling or by limited development. Ore treated during the year amounted to 278,320 tons, the grade being the same as in the previous year. Cost of mining, development and treatment was 79s. 6d. per ton of crude ore compared with 59s. 5d. in the previous year. Most of the increase is due to the higher lead bonus paid to employees. Wages and lead bonus paid were equal to an average yearly remuneration for full time employment of £A818 per man. In the previous year, the comparable earnings were £A645 per man. The lead bonus is paid according to the price realized by the company on lead sales over fixed periods; it ranged during the year from a minimum of £A3-5-0 to a maximum of £A8-15-0 per week, and averaged £A5-13-0 per week. Due largely to the incidence of income tax on wage earners, it has been found that output diminishes with increase in the lead bonus. It is interesting to note that an employee who worked full time during the past year received a total lead bonus of approximately £A290, which was equal to the amount of dividends received in the same period by a shareholder with 2,900 shares.

AFRICA

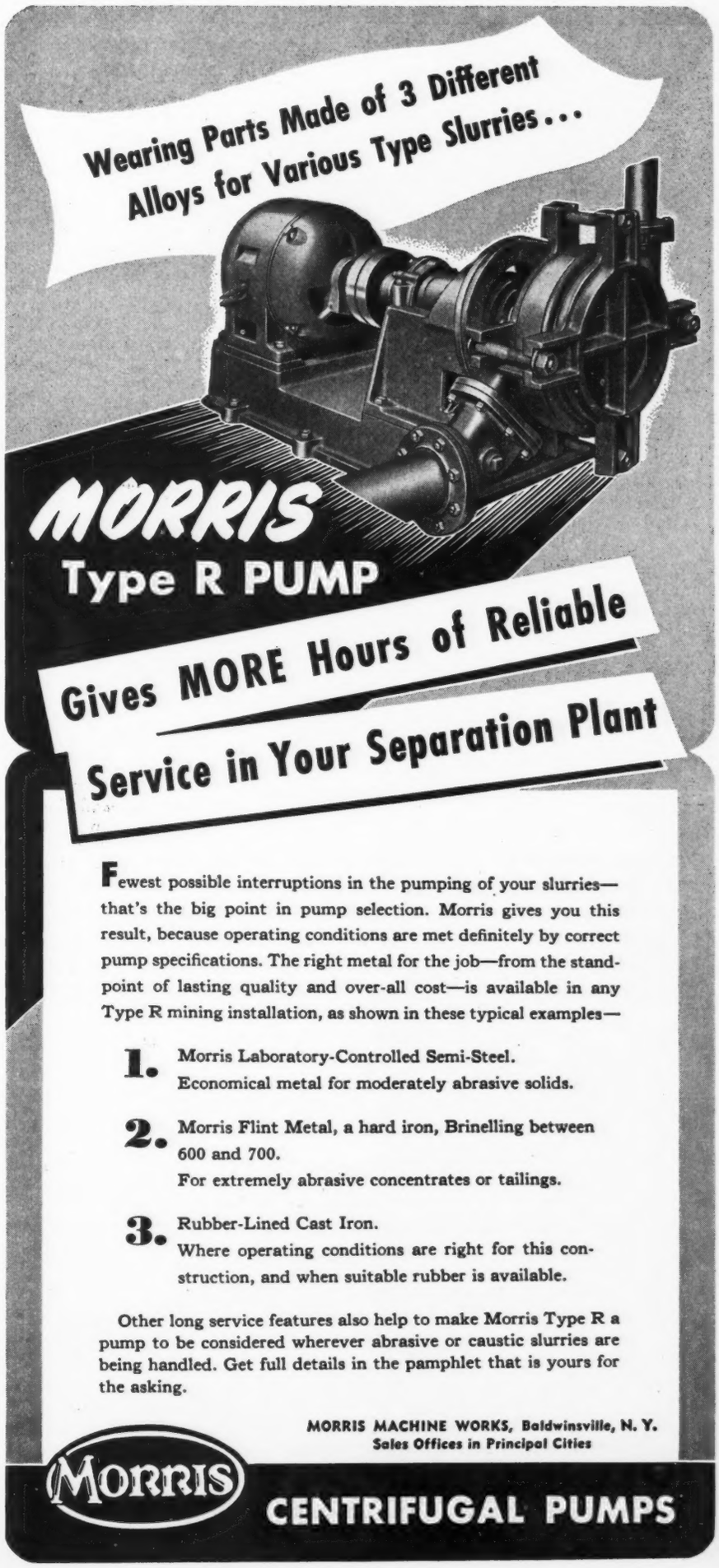
New Union judicial managers make second report—Gold output holds even pace

★New Union Goldfields, Ltd., continues to attract much attention as it works its way back to a sound footing. Placed under judicial management on October 27, 1947, the company is now limping along, short both in staff and funds, while the investigation of its complex financial structure continues. The second report of the judicial managers, published in Johannesburg on January 26, contains the following view:

1. Over-rapid expansion, coupled with ineffectual management and grossly inefficient administration.
2. Secretarial and managerial duties were undertaken for other companies which New Union could not adequately fulfill.
3. New Union accepted very large amounts of money from other concerns on call, and then bought stock with these funds in other companies, or made loans to associated companies.
4. The company for years had been selling large blocks of shares while market conditions were good, but "continual acquisition or flotation of companies for the main purpose of share dealing could not have been continued indefinitely."

In 1947, the revenue of New Union consisted of £208,113 from its mining and other activities, and £1,395,388 as profits on its share dealings. The judicial managers did not feel that the present staff of New Union can handle adequately the job of administering the affairs of the several associated companies, and they have suggested in their second report that Anglo-Transvaal Consolidated Investment Co., Ltd., take over the administration of New Union. Early in February, this question was still being debated by the stockholders. Norbert S. Erleigh and J. Milne, former directors of the company, were still attempting to resolve their own relationships with New Union. The report lists Erleigh's indebtedness to the company as £305,526, and Milne's £175,688.

★Statistics of production and profits for the seven Rand mining houses for December show that 4,560,100 tons was milled, 200 more than in November. Profits were £2,017,197, compared with November's £2,072,035. Highest profit was won by Blyvooruitzicht, with £210,882. Daggafontein (Anglo-American) showed a profit of £198,057. Others yielding six-figure profits were: E.R.P.M. (Rand Mines), £150,599; Grootvlei (Union Corporation), £170,579; Sub-Nigel (New Con. Goldfields), £137,835. The Van Dyke mine (Union Corporation) suffered a loss of £21,890, owing mainly to an underground fire that cut production.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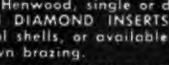

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PHILIPPINES

Benguet moves first ore train—Ask change in mining law—Soriano has new gold mine near Manila

★The first train of ore from the Benguet Consolidated Mines was run through the Benguet haulage tunnel to the new mill on December 15, 1947. Actual mill production started January 1 at the rate of 400 tons per day, and reached 875 tons by the end of the month. It is expected that 1,200 tons daily will be milled within another 30 days. Further increase in mill capacity depends on arrival of additional machinery and equipment from the United States, with the ultimate milling rate set at 4,000 tons per day. The first mill cleanup was made January 13, and disclosed that the average value of the mill heads was $10 per ton, with a recovery of 92%. In the opinion of the mine executives, the performance of the new mill will be better than the mills destroyed during the war. Lower overall costs appear possible on account of concentration of all milling operations in one place instead of three. Plenty of power is available for milling.

★The Benguet management reports that a re-survey of the ore reserves as of January, 1948, showed 1,515,268 tons of positive and probable ore, valued at $11.36 per ton, and the Balatoc mine on the same date had 2,422,796 tons of $9.27 average value. Total reserves were declared to have a gross value exceeding $31,200,000. More than $7,200,000 has been spent by the Benguet Consolidated Co. in its rehabilitation program since recovery of the property from the Japanese. All this has been provided from the company's cash resources and bank loans, without any financial aid from the government or payment of war damage claims already filed.

★Mindanao Mother Lode Mining Co. announced that December production came to $87,000 from 2,900 tons milled, indicating a recovery of $30 per ton. This represented a substantial increase over the November recovery of $35,500 from 1,900 tons milled, and indicates that some production was being obtained from the high grade orebodies on the 700 level, which was unwatered last month.

★Newest gold producer in the Philippines is the Antipolo, which will subsequently be known as the Taysan Mining Co. This property, only a short distance from Manila, has been acquired by Soriano interests. A winze has been sunk from the 300 to the 400-ft. level, with good results from drifting on this level. Immediate plans call for sinking to the 500, where diamond drilling is proposed to prospect for parallel vein structures. The old company's 75-ton cya-

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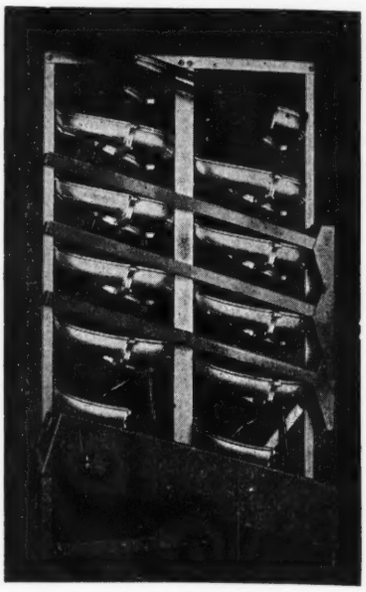

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nide mill, completed just before the outbreak of the war, was little damaged during the occupation years.

★Manganese mining is attracting considerable attention in the Philippines, especially on Busuanga Island, one of the Palawan group. Bureau of Mines engineers have made careful surveys of the principal properties. The Palawan Manganese Co. is building a road and will be able to ship 1,500 tons as soon as completed, with further shipments of 10,000 tons probable later in the year. In the opinion of the government engineers, the Minit deposit on the northern part of Busuanga has the best future, with an indicated 52,000 tons of ore available. Assays of 53% manganese are reported.

★Mining men have asked for changes in the Philippine mining law, which was approved November 7, 1936, as Commonwealth Act. No. 137. While its provisions have never been rigidly enforced, in theory only three lode claims can be located by a single individual or corporation on the same vein, and the same number for a placer. It is pointed out that this provision, if adhered to, may seriously limit the interest of large American corporations in investing in the Philippines. It is also demanded that rentals and royalties should be established at the commencement of a lease and not be subject to change during its duration.

MEXICO

Labor out as topic at big meeting on mining—Permission now needed to shutdown—Three unions form pact

★Much to the annoyance of the miners' union, labor representatives, and discussion of labor matters, have been excluded from the conference on mining in Mexico, which was scheduled to begin in Mexico City, March 8. Employer representatives of every mining company in Mexico will meet with representatives of Government to talk over every phase of the Mexican mining industry, except labor. Originally labor problems were on the agenda, but they were later dropped without explanation. The meeting was called by Sr. Antonio Ruiz Galindo, secretary of national economy.

★Negotiations for new collective contracts are now underway at 84 various mining operations, and settlement of all of them is not expected until well along in April. These negotiations are not expected to result in a general strike like the one of five years ago, inasmuch as wage increases are likely to be granted. A few scattered strikes are regarded by most observers as probable.

★The Mexican Supreme Court has recently ruled that no mining com-

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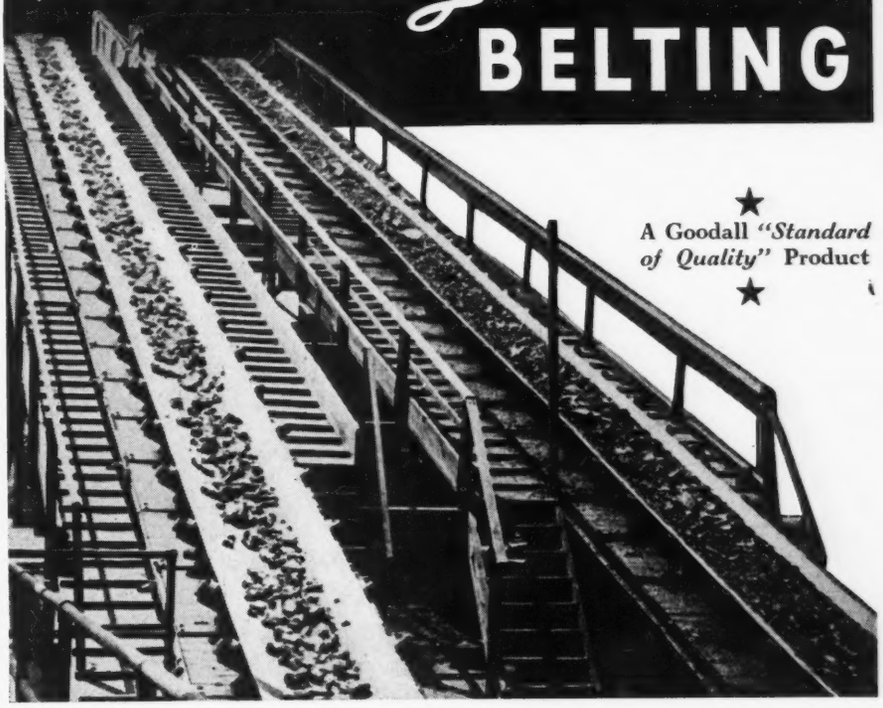

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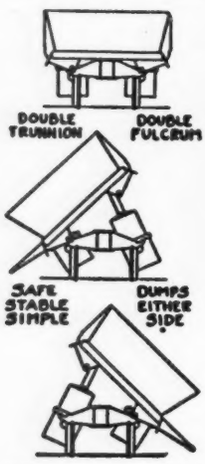

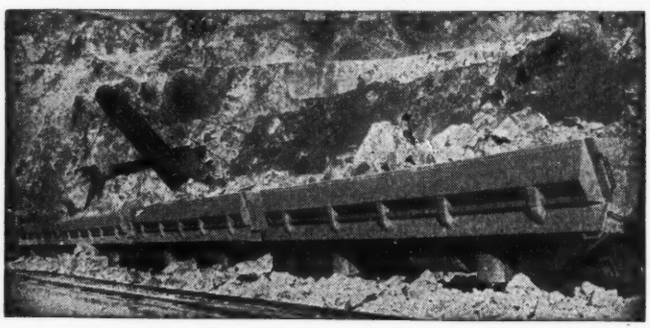

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Mexico *(Continued)*

pany in Mexico, either Mexican or foreign-owned, can be shut down without official permission. This applies to all holders of concessions or exploitation permits, temporary or permanent. This ruling upholds the Presidential decree of December 31, 1943. Several mining companies had asked an injunction against this decree, holding that their concessions antedated the decree and should not therefore be affected by it. The Court cited the expropriation of the oil companies by the Cardenas Government in 1938 as a precedent for the retroactivity.

★The big three labor unions in Mexico, the miners, the railroad workers, and the oil field workers, united recently in a "workers' solidarity" pact that has many employers worried for fear of a general strike. The announcement of the pact stated "this consolidation is neither communistic nor anti-communistic. It is the syndical struggle of the people for the people." According to Agustin Guzman V., secretary of the miners' union, the workers total 149,000.

★Cananea Consolidated Copper Co., Sonora, has been relieved of a series of *"paros,"* short sit-down strikes by action of the Labor Ministry. The trouble is said to have arisen from the union's demand for the dismissal of five foremen, two Americans and three Mexicans. Lic. Manuel Ramirez Vasquez, acting secretary of labor, is reported to have helped the company and the union come to an agreement.

★The value of Mexico's mining production in 1947 amounted to 1,212,000,000 pesos ($243,150,000), according to the ministry of national economy. This compares with 826,000,000 pesos in 1943 and 618,000,000 pesos in 1939. Among difficulties hampering the mining industry, the ministry cited: freezing prices of metals during the war, mounting production costs, deficient services, particularly transportation.

CHILE

Andacollo again producing—Andes labor case to arbitrator—More iron ore found in southern Chile

★Andacollo, famous for its gold placers even before the arrival of the *conquistadores,* is again producing almost 1,300 oz. of gold per month, this time from its lode mines. More than 50 Chilean-type mills are grinding over 200 tons of ore per day in the district. These mills are made of discarded locomotive tires, built up with cement and scrap iron. Cost of milling is about $2 per ton. The ores treated average about 0.22 oz. gold per ton. The *Caja de Credito Minero* is helping miners in Andacollo by selling power at low rates, by supplying water from nearby wells, and by selling machinery on liberal terms.

★Despite a great shortage of building materials, construction work is going ahead on the new copper smelter at Paipote. Housing for construction workers is finished, and warehouses built. Surveys of the area have been completed, and water wells are being drilled.

★Negotiations for a new contract began last October at Andes Copper Mining Co., Potrerillos, Chile. The Government, considering the situation deadlocked, has appointed a member of the Santiago Court of Appeals as arbitrator.

★Geologists from the Chilean Bureau of Mines and the *Caja de Credito Minero* have been examining large iron outcrops in southern Chile. The orebodies are said to be very large, but low grade. They extend over an area of 200,000 acres near a place called Relun in the Nahuelbuta mountain range, about 30 km. from the small town of Capitan Pastene. These deposits have an easy outlet down a river to the sea, and might therefore help supply the new blast furnace being built at San Vicente. Grade of this ore is about 35% to 40% iron, but it is free of sulphur and phosphorus. The ore is said to be of sedimentary origin.